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Radio and Preparedness

The Industry as a Phase of Industrial Mobilization Plans

By Maj. Gen. James G. Harbord*

YOUR medal is deeply appreciated. Like Colonel Payne's gracious introduction, it takes on added value to me because of its source. The Army Ordnance Association is the best bridge that exists between Army thought and American industrial interests. Such bridges insure the civilian-military understanding necessary for our country's preparedness.

Upon industrial preparedness depends our ability to mobilize modern warfare's "hollow square." Army, Navy, citizens, and industry: all four fronts of that strategic quadrangle must respond quickly, and hold steadily, to stand the test of an attack today.

Gone with other simple aspects of bygone eras is the warfare which involved only a fraction of a nation's man power. Modern conflict uses every means to mobilize an entire nation. Supply becomes a staggering problem. Victory no longer results from getting there first with the most men. There must be equal speed with huge quantities of munitions, which include everything that an army in the field can use—ranging from tanks and locomotives to the tiniest radio tube.

Not one of the major powers in 1914 was geared to instant use of the industrial preparedness *talked* about since 1870, when soldiers first heard the term "a nation in arms."

After forty-four years of talk, every great nation should have realized before 1914 the economic struggle a big war was sure to be. An enormous load is placed on industry at the very moment when millions of men are taken from their usual jobs, prices boosted, the law of supply and demand twisted, and imports and exports halted throughout a world that is dependent on interchange of goods.

The United States had from 1914 until 1917 to read that lesson in letters of fire. Once started, our nation's record was one of which we all are proud. Yet we were not able to strike our industrial stride until the war was nearly over.

You, General Crowell, as Assistant Secretary of War and Director of Munitions, were one who helped our nation reach the war industry performance Von Hindenburg ruefully called "brilliant." Only those who saw our halting start in France and the later efficiency after able coördinating agencies at home had taken hold, can realize what industrial preparedness means. America's economic power is the strongest weapon ever forged.

In many a tragedy of the old frontier days, life depended on the quickness of the draw more than on the size of the weapon. We might have no allies to protect us in another fumbling start. How quickly could we draw our potent industrial sword tomorrow if we were forced to it? Would we repeat our delays of 1917?

The War and Navy Departments have worked out together a comprehensive Industrial Mobilization Plan that should insure industrial readiness in the next emergency. First published in 1933 and revised last autumn, it states the agreed policy for both Army and Navy.

Section 5a of the National Defense Act charges the Assistant Secretary of War with procurement of all the Army's military supplies, with provision for mobilizing matériel and industrial organizations essential to war-time needs. In the absence of a law, the Navy has centralized its procurement-planning responsibility by administrative action. Procurement coördination between the War and Navy Departments is established by the Army and Navy Munitions Board, created by agreement between the Secretaries of War and Navy. It guards against competitive bidding, provides for necessary prorating between the two departments, initiates procurement policies, and keeps them up-to-date.

The Army Industrial College trains officers in the broader aspects of industrial mobilization and war-time procurement. For ten months each year it is attended by some fifty officers,

THE following citation accompanied the award of the Ordnance Medal of Merit to General Harbord:

"To Maj. Gen. James G. Harbord, soldier, administrator, humanitarian, for distinguished leadership of the military forces of the United States and for administrative ability in peace and in war. The Army Ordnance Association acclaims the former Deputy Chief of Staff of the United States Army who rose from the ranks to heroic battle command of the Marine Brigade and the Second Division, American Expeditionary Forces, for his skillful and successful leadership in administering the Services of Supply, American Expeditionary Forces; for his peace-time counsel as head of the Harbord Board, to the cause of industrial preparedness as a guarantee of peace; and for his magnanimous contributions to the industrial development and social betterment of the United States as soldier, humanitarian, and public-spirited citizen."

*Chairman, Board of Directors, Radio Corporation of America. Deputy Chief of Staff, U. S. Army, 1921. Chief of Staff, A.E.F. in France. Commander, Marine Brigade and 2nd Division, A.E.F. Commanding General, Services of Supply, A.E.F. Awarded Distinguished Service Medal of both Army and Navy and French Croix de Guerre with two palms. Commander, Legion of Honor. Major General, U. S. Army, Retired.

This is an address delivered before the Eighteenth Annual Meeting of the Army Ordnance Association at the Mayflower Hotel, Washington, D. C., May 12, 1937, when the Ordnance Medal of Merit was conferred upon General Harbord.

about ten of whom come from the Navy and Marine Corps. The classes are addressed by the ablest economists, labor leaders, and industrialists in the country.

IN the quality and speed of its manufacturing, American industry is prepared. The rapidity with which it can turn out equipment if our country needs it depends only on the functioning of mobilization plans. It is unquestionable that our industrial preparedness today surpasses that of any previous time in peace. Press estimates state 20,000 factories have been surveyed since 1920, and 12,000 selected as possible sources for the Army's shopping list for war. The list is said to have been cut to about 200,000 articles—not the 700,000 that cluttered it in 1917-1918.

Tracing how the Industrial Mobilization Plan applies to the radio industry may be a good indication of its effectiveness, for this is new ground. There is no excuse for following the all-too-common habit of "preparing for the last war" in planning what radio should do in the next. As a brave beginner it gave good account of itself in 1917-1918. Thanks for that go to emergency research directed by Navy and Army experts aided by the best talent of private companies, and to the practical suspension, for the time, of scattered essential patents. But radio was still as young as a drummer boy when the Armistice was signed.

Feeble radio signals of prewar days now have been superseded by powerful transoceanic and marine radiotelegraphy linking this nation with every land and with vessels on the farthest of the seven seas. Two thousand and twenty radio stations now are licensed on ships of American registry.

Broadcasting was unknown when the war ended. Today more than twenty-four million homes in the United States and four and one-half million automobiles have radio receivers. Six hundred ninety broadcasting stations compete for attention in this country. Our radio industry sold 8,250,000 radio receivers and ninety-eight million tubes in 1936—receivers and tubes capable of a performance never dreamed in 1918.

Radio facsimile, unknown in the World War, now flashes pictures and maps through the ether and reproduces them exactly—even across oceans. Engineering field tests of tele vision are bringing it closer to introduction as a practical public service. Research in all branches of radio day by day pushes the horizon farther out. Such industrial radio attainments offer military possibilities that did not exist in the dim prewar days. Radio will be a vital factor in the conduct of the next war.

Radio is today—and probably always will be—the sole means of rapid and reliable 2-way communication between elements in the air and on the water, with one another, and with points on land. It requires no stringing of wires, sometimes under shell fire. In our Army's motorization and mechanization, radio is indispensable to command coördination. Even in slow-moving situations it is the main reliance when wire lines go out.

MEASURING what our radio industry can do to provide indispensable equipment for military needs is one task of the Army and Navy in their industrial mobilization planning. They are performing the task creditably. Each is coöperating with the other and with the radio industry. They are learning where they can get radio equipment quickly with a minimum of overlapping, what kind, how much, and how fast.

The war procurement plans of the Army and the Navy differ in detail, but conform in principle. We can understand the story by following it through in the Army—remembering always that the Navy has a comparable narrative. The Chief Signal Officer, also the head of a combat arm, is charged with the development and procurement of equipment for Army signal communications. He charts what radio apparatus will be needed by the Army in any given emergency. To guard against delivery delays, requirements generally are tabulated for each 30-day period after M-day, then set forward one month.

With requirements thus estimated, the Chief Signal Officer adjusts apportionments and divides loads tentatively, considering the needs of both Army and industry. Geographical diversification is sought, so far as practical. He then sends his requisition for allocation to the Planning Branch in the Office of the Assistant Secretary of War, whose Allocations Division maintains a central record of allocations, passes on requisitions, and adjusts conflicting Army demands.

WHEN the Army and Navy desire to use the same sources, conflicting interests are referred to the Army and Navy Munitions Board. Joint use of commercial plants is avoided when possible, but in radio and some other fields it has been found necessary to have some factories serve both departments. In such cases, capacity credits against the factories are assigned by the Army and Navy Munitions Board. Consideration is given to the needs of the civil population. The Office of the Assistant Secretary of War feels that the capacity of the radio industry in America is ample for emergency needs.

After a radio production facility has been tentatively selected, the Signal Corps makes detailed surveys. Ownership and management are studied, as well as quality and quantity capacity. Under the Industrial Mobilization Plan, the Signal Corps has surveyed approximately 1400 manufacturers of electrical communication equipment—including all principal radio plants—and has selected about 400 as sources of supply. The Navy has conducted similar extensive surveys. Data have been obtained not only from individual companies but also from the Radio Manufacturers Association. Selected manufacturers are requested to sign a statement—though not a contract—expressing willingness in emergency to enter into an agreement with the authorities to produce certain items within a certain time.

The procedure culminates in written plans, a separate one for each item, containing concise shipping information. These are analyzed in the Office of the Assistant Secretary of War by the Procurement Plans Division of the Planning Branch, and approved or returned for corrections. On June 30th of each year the Chief Signal Officer submits a program of procurement plans to be prepared or revised in the approaching fiscal year. Plans are revised as often as is considered necessary, but a maximum of no more than three years between revisions is permitted.

I AM glad to read in the War Department's announcements the sentence: "Conformity with commercial standards and commercial practice is diligently sought." I have seen this problem of standardizing equipment from both sides—in the Army and in industry. A sometimes unnecessary insistence by military authorities upon unique specifications would be a stumblingblock to speedy industrial mobilization. The Office of the Assistant Secretary of War will not now clear an item

for procurement until the design has been referred to the interested industry for comment on the possibilities for emergency mass production.

Efficient industrial preparedness depends on more than mere outlining of finished articles to be obtained quickly. Part of the problem is how factories which could turn those articles out easily in peace could do it if a war blocked imports of raw materials. Contemplation of the great industrial strength of our country should not trick us into the easy assumption that she is entirely self-sufficient. Our steel industry, for instance, absorbs the largest part of the world's nickel output, but none is produced here.

The present high standard of many industrial products depends on imports. Radio is an example, although the predominant part of its raw materials comes from America. The list of raw materials currently defined by the Munitions Board as "strategic" shows me at least six of the twenty-three are used to some extent in radio. Of fifty-two materials now listed as "critical"—also essential to defense, but presenting a little less difficult procurement problem—I see at once fifteen that are used in radio.

To avoid the raw-material scramble of the early days of the World War, commodity studies coördinated by the Joint Munitions Board are an important part of Army and Navy planning. As an illustration of the thoroughness of this phase of our industrial mobilization plans, take what would appear to be a relatively insignificant material—mica. Mica is a "strategic" material, largely imported. Radio tubes, aviation spark plugs, and some Ordnance items require it. An officer of the Signal Corps is chairman of a special Committee on Mica, and the membership includes officers from the Air Corps and Ordnance. It is the function of this committee to be thoroughly familiar with diversified sources of supply outside the United States, with potential new sources within our own borders, with the development of possible substitutes, with our current industrial inventory, and with both our peace-time and war-time requirements. In case of war, the committee would be in a position to build up our national stock of mica with a minimum of delay.

In a rapidly developing industry like radio, with laboratories constantly making new inventions, plans for full industrial preparedness would be lax indeed if they assumed that progress and invention in the industry had ceased, and if they stopped with equipment now available. If, in an approaching day, television becomes a practical, far-seeing military eye, as well as a keen ear, they should be ready. Both departments maintain constant liaison with radio's industrial laboratories and with the Radio Manufacturers Association. Every advance is studied for possible military applications.

Of course, some of the most exciting things are secret, but one application of radio principles described a few days ago in the press was a rapid-fire gun with synchronizers tuned to the roar of an attacking plane. The synchronizers keep the muzzle pointed at the target. In practice, the newspapers state, those guns show an accuracy far beyond the World War record.

ALL these plans for industrial preparedness warm the blood of us who sometimes felt it chill a little while waiting for essential shipments in those bleak early days in France. Yet, all of us know there is often a difference between "paper work" and results. Frankly, no one can tell how any plan will work in a crisis until it is actually tried in a crisis. But before the acid test there are indications upon which we may base sound hopes.

In addition to consultations with factory executives on what radio could do in a pinch, I notice another indication that some of the plan's vision is becoming reality. It is that many more of our radio men know their opposite files in the Army and Navy since the new policy was developed. They meet as fellow radio enthusiasts, often in the Reserves,

COL. FREDERICK H. PAYNE, vice-president of the Army Ordnance Association, chairman of the Association's Committee on Award, and former Assistant Secretary of War, when naming General Harbord to receive the Medal of Merit at the Eighteenth Annual Meeting of the Association, May 12, 1937, said:

"Mr. President, your Committee was unanimous in its choice of our medalist tonight. He is acclaimed universally as the finest type of American soldier. I am sure that every officer and man of the Army who has served under him—and they are reckoned in the hundreds of thousands—has done so with a sense of personal loyalty and satisfaction. Few other officers of the American Expeditionary Forces had such broad experience as he did because he was concerned in every phase of the activities of that historic expedition. He was Chief of Staff of the American Expeditionary Forces during the first year—the year of organization, and planning, and building, and training. He commanded first a brigade and then a division, and led them with distinction through important battles. He was the Commanding General of the Services of Supply during the time of that organization's greatest and most important activity. In this he showed executive ability of the highest order. After the Armistice he again became Chief of Staff, A.E.F., and directed the return movement to the United States.

"He has made a monumental contribution to the military literature of the United States in his book 'The American Army in France.' Having held high and responsible positions in every phase of the activities of that body, and being endowed with a clear, precise and logical mind, he is exceptionally equipped to have written that record. In this, as in every detail of a long and honored military career, it may be said that he succeeded in everything he undertook.

"In addition to all this, the candidate your Committee has selected to receive the Ordnance Medal of Merit has attained great distinction in the world of commerce. Since his retirement from the Army he has led one of our country's greatest forces for public enlightenment by his leadership in the field of radio communication. He is a humanitarian in the best and most practical meaning of that term. We have come to expect from our great military leaders the same high achievement in peaceful pursuits. Our nominee for honors tonight has not failed ever in the slightest degree to meet that expectation."

and get well enough acquainted to call one another, and the dignified radio apparatus, by nicknames. This is only one example of advance in the present military consciousness of industry's existence, from the comparatively cloistered attitude of prewar days. The Industrial Mobilization Plan has been a big factor in that fortunate change. The closer the understanding between Navy, Army, and industry, the quicker industry can be mobilized if the drums roll again.

The Industrial Mobilization Plan goes beyond initial procurement. It proposes that a War Resources Administration be established by the President if a war emergency became imminent. Such an agency—a development of the War Industries Board which functioned so well in the war—could operate to a limited degree under the inherent powers of government and the existing legislation until additional legislation which the plan has outlined is secured. Planning agencies of the Army and Navy, having provided for the initial placing of orders on war's outbreak, would carry on until this proposed agency is ready to clear requirements of the civil population, Government agencies, and industry. After that, the Army and Navy Munitions Board would continue to function as a procurement coördinating agency for the two departments.

In this discussion I confine myself to plans for the initial movement, as they are exemplified in radio. The intricate second phase of economic mobilization—putting the nation's assets to the most effective use after the first onset of a crisis—is outside the province of a talk on radio. I might say, in passing, that I consider a law permitting the President to mobilize industry without delay is as essential as one permitting him to call men to the colors by selective service. Neither is on the statute books. If possible, the profit motive should not be allowed to enter.

Thus far I have been speaking of the manufacture of radio equipment. The fact that the United States leads the world in radio *services,* as well as manufacturing, has real bearing on our national safety. The great network of transoceanic radio circuits which has been developed since 1920 cannot be cut by an enemy, as cables were in the World War. They will go on carrying messages and news, essential to the conduct of a big conflict and to the maintenance of civilian morale. They, as well as the marine services, will continue to flash radiograms aiding shipments—a critical factor in modern war's economic grapple.

The coöperation of commercial radio services with the Navy and Army in peace time assures skillful coöperation in emergency. Marine radio constantly assists the Coast Guard by speeding information affecting life at sea. Weather reports, notices to mariners, and all sorts of bulletins on ocean conditions are freely exchanged with the Navy.

The report of Secretary Swanson for the last fiscal year contains this significant statement: "Radio stations of the Radio Corporation of America and the Mackay Radio and Telegraph Company near San Francisco participated in the annual fleet problem, rendering services of a high order."

DURING the World War, the only use for radio was for point-to-point communications. There was no broadcasting as we know it today. Broadcasting was a "war baby"—and the baby has now come of age. Many of the nations of Europe today are demonstrating that propaganda broadcast by radio—both for home and foreign consumption—has become an important instrument of modern warfare. In case of war, all broadcast receiving sets in America will become targets for enemy transmitters, whereas our broadcasting stations will be carrying our own story to the rest of the world. The series of broadcasts from Spain, available to American short-wave listeners, is an indication of what may be expected. Our geographical isolation would be a help, for our home receivers are distant from potential enemies. Fortunately, the improbability of effective air raids makes unnecessary the underground studios the British Broadcasting Company is planning for London.

Radio personnel is really a phase of its industrial mobilization. Quite aside from the supply of excellent apparatus and services the growth of American radio has created is the great body of expert technicians. The Naval Communication Reserve and the Signal Corps Reserve are proud of the proportion of men they have who are employed in the radio industry or who are outstanding licensed amateurs. Approximately 600 men in the Radio Corporation of America services have joined communication Reserves, entirely on their own initiative. Other radio companies could doubtless report a similar situation. Those men know radio technique, or the feel of a radiotelegraph key as well as the Minute Men knew the touch of a flintlock's trigger; better, perhaps than Paul Revere—silversmith—knew the feel of reins and spurs.

The war-emergency value of the nation-wide group our radio era has made skillful and enthusiastic, is not to be measured solely by the number now in the Reserves. Here is a potential source of the best possible radio-communication recruits. The latest report of the Federal Communications Commission shows 46,850 licensed radio amateurs in the United States—amateurs whose ability and response to civic duty has become traditional in storm, fire, and high water.

The Navy, working closely with civilian operators, estimates that in a national disaster it could mobilize a network of 2500 amateur stations within two hours. The Army enlarges its contact through the Army Amateur Radio System, which includes 1394 operators selected for proficiency. Supervision is exercised by the Chief Signal Officer. Membership is by invitation, without physical examination, pay, or gift of equipment, but with no agreement to serve in war. Members are actuated by eagerness to be ready for disaster relief work, and by their ambition to improve by weekly training in Army methods of radio operation.

I am sure the spirit of radio men is typical of those in all American industry. Matching the devotion of the little band of pioneer technicians who served the youthful radio of the World War, there are many in the large group who have proudly helped it through adolescence, who would meet another emergency with the developed radio of the present.

Given our powerful industries to produce equipment; given men who know how to use it—and, above all, an Industrial Mobilization Plan that will work—we need not fear that those whom America may some day call to fight for her will be hampered by unpreparedness at home.

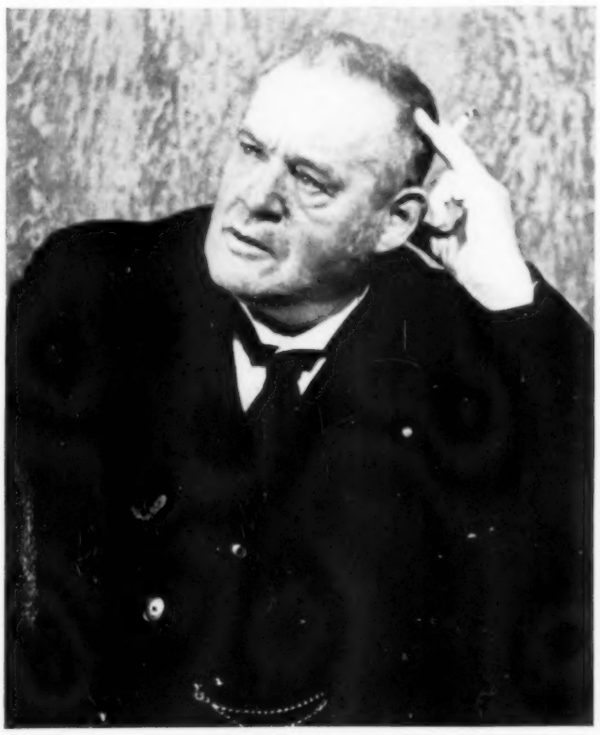
The United States is a peace-loving nation. If the cruel necessity arises, however, I am confident that we shall be able to demonstrate that love of peace is not necessarily a military handicap. The arts of peace reach their highest perfection when directed by the private initiative of a free people. Those arts, and that initiative—if they can be quickly and efficiently mobilized—should become the most powerful support that any nation in the world is capable of putting behind its armed forces in the field, on the seas, or aloft.

Tomorrow's War

One Thing Is Certain—It Will Not Be Yesterday's

By Hilaire Belloc*

I RISE not only with diffidence but with a great deal of nervousness to speak on this occasion. It is more than nervousness; it is a condition of incompetence. I suffer from three disabilities. I am a civilian, an amateur, and I am from England. As a civilian I come before you as an adjective; as an amateur I come before you incompetent; and as coming from England I am alien and therefore ignorant of your conditions.



HILAIRE BELLOC

My only claim to speak to soldiers is that I was, in my youth, a gunner. I was one of the first men to fire a 75. It was during one of the early experiments on this weapon. I have always recalled that incident with a great deal of pride—that I was one of the first men to fire a 75 in maneuvers. That was in the camp of Chalons when I was a very young man. I wish that I were one now!

I come before you, therefore, quite incompetent for any advice or any use whatsoever. But now and then in the Darker Ages, when there was great turmoil, they used to take hold of a child or a lunatic and say, "Let us hear what you have got to say," and what he had to say was taken as an oracle. You will find before I get to the end of this that I am not an oracle, and, moreover, that I am muddle-headed about everything. But I will do my best.

There has already been quoted to you on the radio that admirable phrase invented by the French—who for more than two thousand years have been amusing themselves experimenting with the art of war. (As Julius Cæsar said, the two things they care about are spouting rhetoric and warfare; rhetoric is rather a waste of time, but warfare is worth considering.) The phrase in question runs *On prepare toujours la dernière guerre*—"Men always carefully make plans for carrying out the *last* war."

Well, that is inevitable. We know all about the last war, and it occupies our imaginations and our experience. We know nothing about the future. How can we prepare for something we know nothing about? But we all know that preparing for the last war has fatal results.

THERE are three things that you have got to consider about any possibly coming war, and the first is *the occasion of war*—why a war comes on. The second is *the field of action*. According to whether the war is of this or that sort, the field of action will be diverse. If it is going to be a great national war, the field will be a national field, and if it is going to be a local war, it will be a local field, and if it is going to be a class war, it will be a class field—fighting between citizens of one city. If it is going to be a religious war, it will be a religious field—fighting between religious groups. Other forms of war will occur to you—any number of them.

War is the conflict between human wills. It is the point at which men are not content unless they impose their will by force upon other men. That is war. Some years ago I had a motor car (I mean an automobile—I beg your pardon!) and in front of me there was a man with a large cart who wouldn't get out of the way. So I said, "Get out of the way or you will be the worse for it." He answered, "Keep your hair on!" I debated with myself whether I would smash my car by charging him and probably go to jail as well, or give way. I gave way. There was an example of a conflict between human wills, about to be decided by force; and his assets of force in that particular field were greater than mine. He won. All war is simply that: two wills are in conflict and the conflict only can be decided by force; and when you come to use force, the one or the other force wins, either by actual conflict or giving way before it because you fear a superior force.

Closely attached to the occasion of war is the field of war. On what the occasion may be depends the field, and closely attached to that is the third point, the technique—how are you going to fight your war?

The occasion of war, the field of war, and the technique of war—those three things are diverse, but each is related to the other, and this diversity is the reason it is so difficult to say what the future war will be.

On the first point, the occasion of war, men go enormously

*Author: "Napoleon," "Richlieu," "Wolsey," "Cranmer," "James II," "Joan of Arc," "Danton," "Marie Antoinette," "Robespierre," "History of England," "Miniatures of French History," "History of the Great War," and many other historical studies, essays, etc. London, England.

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wide of the mark—they always have done so. They always think the conflict of wills is going to be what it was in the immediate past, and always it is something quite different. The wars of the Middle Ages were feudal; suddenly they turned into wars of religion. Men had to change their viewpoint; they had to do something quite different from what their fathers had done to meet the situation.

There have been wars in which people didn't even think of the value of sea power, when suddenly sea power became everything. There have been wars in which men never considered for a moment that this or that which they had scarcely heard of would become important, and of a sudden this or that became vastly important. For example, the class war suddenly comes where before there had been only wars between nations.

More than on anything else, then, do men, when they are thinking of the future, go wrong on the occasion of a coming war. They go pretty wrong on the next point, the field of war. I will give you an example: There was fought within a day's march of the town of Warsaw what is called by an acute observer—Lord D'Abernon—a battle which he almost called "the last decisive battle of the world." He didn't actually call it the last, but he called it "the seventeenth," because there had been a rather well-known book published before his time called "The Sixteen Decisive Battles of the World." You can't catalog battles in that way. But anyhow, he was right in saying that Warsaw was a decisive battle. Bolshevism was sweeping Europe much as the Mohammedans had swept over Europe many hundreds of years ago, and the battle of Warsaw stopped it.

Now, what decided the battle of Warsaw? Cavalry. If there was one thing that the technical man, the soldier, would have said would not count any more after the Great War, it was cavalry. That great charge of the French cavalry at the end of the battle of Champagne in August 1917 came to nothing. The Germans in their report ridiculed it, saying that the French didn't understand the situation—and the Germans were quite right; but the battle of Warsaw was decided by cavalry. I would like also to think that it was decided in some degree by the organizing genius of Weygand. Uhlans, Polish by birth and race, trained during the partition of Poland under German management—which as you know was excellent—Polish Uhlans decided that battle. No one could have guessed it, and no one could have thought that it possibly could happen; but it did happen. The field of the campaign and battle of Warsaw were not what had been expected, and neither was the technique. The whole thing was unexpected and out of line with the vast recent experience of the Great War.

TAKE one very small point, on which we are still debating—one point out of many: What is the effect of aërial warfare?—what can aërial warfare do against troops on the ground? There is one school which says it will effect hardly anything, and another school which says that it will be decisive; and though you have the experience of the present war in Spain, the two schools go on saying "What did I tell you?"

One school points out that in the advance on Madrid the airplane mastered the infantry in the field and could do what it liked with the men on the ground; and the other says, "Not at all; it was only a momentary advantage, and later it didn't count." Thus far the second school has had, on the whole, the better of the argument. But at any rate, we don't know the full truth even on that one technical point, though it is all-important. We simply don't know even yet, the relative values of bombing attacks from the air on the resisting power of infantry on the ground.

Another example of technique in which a huge blunder was made, was the Allies and the French not understanding at the opening of the Great War what the machine gun would do in the field. The Germans understood it, and all their early successes depended upon it.

As another example of not understanding what unexpected technique means, you have the very curious fact that during the early revolutionary wars of the French against the rest of Europe, 1792 to 1793, there appeared the technique of a new open order. Men spread out, leaving distances between each individual and the next. And why did they do it? Because they couldn't stand fire. They were raw recruits, and once they began to fall in great numbers they said, "We can't stand this; it is too much for us," so they spread out from lack of discipline and cohesion. And yet, by so spreading out, they developed a new technique despite themselves. It was this technique which made possible all the early victories.

There is a very amusing and true anecdote about the early revolutionary wars in France, which I will now tell you. At the beginning of the action at Hoondschooté, which turned in favor of the French, some men stood half hidden in a ditch. They had been told to get in the ditch because they were in danger of being shot at if they showed their heads above the ditch. They stood in the water and hated it, but they preferred being in the water almost up to their necks, to getting killed. When the fire got too hot, one of them put his hat on top of his bayonet, waved it, and shouted to the enemy: "Don't fire! There are people here!"

It was this deplorable spirit which developed the open order of the early revolutionary wars, and when developed, in spite of its ridiculous origin, it succeeded. It proved the salvation of those huge, ill-disciplined levies of the Republic. A detailed example of this would be that battle on the upper Saar, when Prince Henry of Prussia was killed in the first action before the Battle of Jena when Napoleon was turning the right flank of the Prussians. If you will read about it in detail you will find that the success was due, or mainly due, to the fact that the new French armies, though now already for a dozen years accustomed to fire, were still spreading out in open order to prevent greater losses. There were too many young raw recruits among them who didn't like to face fire, and they developed, by that accident, the technique of the open order on which the rest of the battles were fought and won.

When old Blücher surrendered at Lubeck "with a sword at his back," as the saying goes, he could say to himself, "I have been defeated by the new open order." Heaven knows he was a very great soldier, but he had never seen anything except massed troops. That splendid Prussian infantry of 1806 which went up in one body, one solid phalanx, and was shot down in front of the windmill, was what Blücher had known. He understood *that*—but he didn't know what the new open order would do. What it did was to make a new kind of war.

There are certain other things to be said. First of all, the rapidity of modern change in armament is such that it is difficult for us to appreciate what the technique may be in future wars. That rapidity of change you, gentlemen, know far better than I. The airplane has been quoted. Much else might be quoted; as the rapidity of fire in heavy guns, the range of their fire and their maneuverability. And all these things are changing in one way or another almost every day.

NEXT there is morale; on that one item we might debate all night long. In the technique of the coming war, or any war, one has to estimate the new morale. What kind of human beings will you be dealing with? Will they stand the strain or will they not? What kind of a strain will they stand? For how long? On that score we know little—even after four years of warfare involving millions of armed men at a time.

A new war breaks out. Suppose it be a social war, that is, a war between social classes. How will discipline in great conscript armies be affected by class war? Men fight well when they are disciplined and are determined; they fight ill when they are neither one nor the other. Sometimes, men will fight very well when they are determined and desperate for a short time, and collapse because they can't keep it up. At other times men will begin very badly and end very well.

Of a future war, on the whole, we know almost nothing. We know generally that the professional armies, with traditions, will fight better, and mature better, and stand things strongly, where mere recruits and mere conscripts, bunched up together in a new army, will fight badly. But they may be very angry indeed and the others may not care very much.

Morale, as Napoleon said, and he knew something about it, is to material force, or numbers, as three to one. He may have exaggerated, as people do when they make epigrams, but morale does count enormously; and if I were not being reported (a thing I hate) I could give you examples of good and bad morale, but if I did that, it would get me into trouble. Let me say no more than this: We all know of men who under fire act quite differently from the way in which men apparently similar will act. One body will be steady; another, apparently identical, will break. There is an unknown factor, and that unknown factor we call morale. No one knows until action begins what morale will appear.

Technicians who understand the art of war think mainly in terms of mathematics, and say, "I have so many battalions; he has only so many battalions, therefore he can't outflank me," and so on. But success depends not only on how *many* men we are using but on *who* the men are we are using. We don't know *who* the men will be whom we are going to use in a new war. The very people that we most admire today for their discipline, and their tradition, have been in the past proved very poor soldiers indeed, and may be so again. Conversely, some of those whom we long despised, have recently shown very great vigor and tenacity. It is a matter of organization; it is a matter of what they are fighting for; and it is a matter of tradition within their units, and so on. At any rate, on morale we are in doubt.

And lastly, a very important point—which I do desire to put before you after having spent four months in this country hearing about the politics of Europe and reading about them in your press—there is a civilian view, a very common one and very widespread, as to the morale value of opposing nations.

When Great Britain was struggling against the claims of the Italians last year in the Ethiopian campaign, one heard all over England the phrase: "These people are Dagos, they are ice-cream sellers; we needn't take them seriously." Well, in my judgment that was a mistake.

A change has come over the morale of the Italians since the Mussolini régime. Conversely, to give you a sample of the other side, when the French went to Madagascar, when I was a young man, the one thing they feared was the tribe which long had led all the other tribes in war. The French were sure that this fighting would rally the people of Madagascar against them. When it came to the issue, it turned out that they were worth nothing at all—worth much less than their subject tribes.

We go probably worse on morale than any other point, and I would say to you, especially in this country, you are removed from Europe not so much by three thousand miles as by a lack of traditional contact which malforms your view of the conditions of Europe. Your source of information is through the English tongue, and that is only one source of the many sources from which matters are received, and in that source you are inclined by a number of hereditary leanings by things which you have in common with the English. Well, in the future struggles, if there are to be any struggles, which I doubt, at any rate on a large armed scale, don't run away with that civilian illusion that the other man doesn't count because he is different from you.

Just after the Great War, my chauffeur at home said to me, "Why did the war last so long?" I was about to give him a learned explanation, when he added, "It ought not to have lasted so long. One Englishman is worth three foreigners. Why couldn't we get through? What was the matter?" I told him that it was a matter beyond my comprehension. But if I had told him the truth I would have said that he was only one of many millions who underestimated the enemy.

NOW, these things being so, what are we to do with regard to any future conflict in which we may be engaged? When I say "we" I mean yourself, and myself, and the man in the street everywhere and anywhere. If there is to be a conflict remember these millions who will have the judging of it, well or ill. Remember again that it may not be national; it may be a class war. Again, more probably than not, a new war may be sporadic, not a great war between great organizations, but a war in local fields desperately fought by comparatively small bodies like the one which they are fighting now in Spain.

I take it that we have three things to do. First of all, in all conflict cultivate elasticity. Remember that you have a great many things to do, and that often you must change plans suddenly. Therefore, be elastic in your work! It was the immense advantage of the early revolutionary armies in the wars that they fought against Europe. They cultivated and developed elasticity—they weren't hidebound.

In the admirable Prussian service, the General Staff were better prepared than any in Europe, unequaled by any other, and disciplined, yet they lost the Marne? Why? What was the matter? They lacked elasticity.

Let me tell you a little story about that, which I think may be interesting. In Luxemburg where the Prussian General Staff had their headquarters in the center of that immense crescent of men, Moltke had taken over for his staff work a large building in the place that had been a public school. There, with all his maps spread out, he was working with his staff when there came through the first news of the Marne, the check at the Ourcq on the right flank. The Prussians had bunched, and they had been caught in flank by the French unexpectedly. He went out into the courtyard of the school and sat down on a low wall about the height of this table. He put his head in his hands and abandoned himself to thought. The little boys of Luxemburg gathered around, twenty or thirty of them, making a small mob, wondering to see this old Prussian soldier (for he was old in their eyes) giving away to despair. He knew that the war was lost.

When he had sat there for a few minutes, he rose up wearily and walked back into his office. That was one of the most dramatic points in the history of modern Europe. Lacking elasticity had been the doom of the great army and a great machine. They very nearly won again after the Russian Revolution, but still, that check of the Marne was the origin of their final defeat.

There is another point in history that you may recall. Why did the Romans at first go to pieces before the Carthaginian armies? What was it that they lacked? I put forward the suggestion that they didn't appreciate the impetus of a Gallic cavalry charge. It wasn't only Hannibal. The Carthaginians as fighters were nothing; they were money dealers. But they had hired that Gallic cavalry of which later Julius Cæsar discovered the secret. The Frenchman on horseback is an ingenious fellow.

As for how we should train ourselves in elasticity, if I may make a suggestion, as an amateur I should say it is done by a certain virtue called humility. Never think that you know all about it. Always be ready for the unexpected, and always be ready to learn from an enemy quickly. Say, "After all, he knows more than I thought he did," and act at once on that new knowledge.

On the second point, we must have that which is allied to elasticity; namely, multiplicity—the power of doing several things at once. I think if you look through the history of warfare you will discover this: that between those who fail and those who succeed, there is mainly a difference of multiple action, and those who can do only a few things but do them well, go down before those who do many things less well. How can you acquire multiplicity? Only by training. Only by that which is so much declining nowadays, and which is so very, very valuable—peace-time training. I think the elder officers who listen to me will agree with me here when I say that maneuvers in peace time teach little and yet are invaluable. Only thus do you train officers, from those connected with a small unit, up to the commander of the whole army. Only in maneuvers do you gain the multiplicity of view, the rapidity of change, the diversity of effort which is the mastery of war.

It is true that in maneuvers you aren't fighting as you are in war, and an Englishman put it very well when he said: "If you want to know the difference between maneuvers and war, go to a rifle range and take a shot, aiming very carefully at a target, and then try it the next day with three or four men throwing cricket balls at you. You will find that it disturbs your aim!" Yet it is essentially true that peace-time maneuvers are of the utmost importance in creating the multiplicity of effort, the power of suddenly judging new situations.

NOW I am going to give my last point, which may not be popular, at least to such of you as are, like myself, elderly. That last point is rapid promotion, for rapid promotion makes for the vitality of an army.

The French are today suffering from the slow pace of their promotion; the French of the revolutionary wars were given three-quarters of their value by the rapidity of their promotions. Napoleon was a soldier in his teens; at twenty-three, I think, he became a colonel (I say this at random—I haven't the figures before me), but I know that he commanded the army in Italy before he was twenty-seven.

Today we are hidebound in all of the great services by lack of rapidity of promotion. It is the old story of "what are we to do with the old men?" I don't know. We have outside of a certain famous military club in London, a corner called "Promotion Corner." It is a place around which the taxicabs turn with great rapidity, but it does not effectively *rejeunir les cadres.*

You can, at any rate, in peace time seek out your young men with ability and talent and, against all of the delaying social forces of routine or what not (they will all war against you), against the feeling that it is a shame to shelve that man who has done good work in his time, promote rapidly. If you can promote the young men, you will get many foolish men, many absurdities, but you will have a sort of spirit running through the mass and vivifying the whole.

There is one man who is a grave example of this. For the honor I bear him, I won't give his name, but he is an acknowledged master in the English service. Everybody knows it; yet he is not being used. Why? People say that he is "hard to get on with." Do you suppose that Napoleon would have bothered whether the man who very nearly won the battle of Cambrai in November 1917 was "hard to get on with"?

EDITOR'S NOTE: Mr. Belloc's accurate definition of war (page 13) is little understood today. So also the following from his "The Elements of the Great War—1st Phase," published in 1915:

"The first postulate in all military problems is that, other things being equal, numbers are the decisive factor in war. This does not mean that absolute superiority of numbers decides a campaign necessarily in favor of the superior power. What it means is that *in any particular field,* if armament and discipline are more or less equal on the two sides, the one that has been able to mass the greater number *in that field* will have the victory. He will disperse or capture his enemy, or at the least he will pin him and take away his *initiative*—of which word 'initiative' more later. Now, this field in which one party has the superior numbers can be only a portion of the whole area of operations. But if it is what is called the decisive portion, then he who has superior numbers *in the decisive time and place* will win not only there but everywhere. His local victory involves consequent success along the whole of his line.

"For instance, suppose five men are acting against three. Five is more than three; and if the forces bear upon each other equally, the five will defeat the three. But if the five are so badly handled that they get arranged in groups of two, two, and one, and if the three are so well handled that they strike swiftly at the first isolated two and defeat them, thus bringing up the next isolated two, who are in their turn defeated, the three will, at the end of the struggle, have only one to deal with, and the five will have been beaten by the three because although five is larger than three, yet *in the decisive time and place* the three never have more than two against them. It may be broadly laid down that the whole art of strategics consists for the man with superior numbers in bringing all his numbers to bear, and for the man with inferior numbers in attempting by his cunning to compel his larger opponent to fight in separated portions, and to be defeated in detail.

"As in every art, the developments of these elementary first principles become, with variations of time and place, indefinitely numerous and various. Upon their variety depends all the interest of military history."

Ordnance Principles

Designs, Facilities, and Personnel are the Essentials

By Maj. Gen. William H. Tschappat*

ANY meeting of the Army Ordnance Association is an occasion when those of us who are devoted to ordnance take pride in what this organization is doing for our national defense. Tonight we are gathered together for our eighteenth annual assembly; I have been present at all of them. I congratulate you, General Crowell, on the record of this society, and as Chief of Ordnance, I thank you and your associates for your unfailing help to the Ordnance Department. I feel confident that General Crozier, who is with us tonight and who was Chief of Ordnance for seventeen years, joins me in these same sentiments.

MAJ. GEN. WILLIAM H. TSCHAPPAT
Chief of Ordnance, U. S. Army

Slightly more than twenty years ago, this country embarked upon perhaps its greatest adventure, "to make the world safe for democracy" and to engage in a "war to end wars." Today, with Europe and Asia rearming at a rate never before attempted, and with the United States preparedness-conscious to a degree not realized since World War days, it is fitting that we stop for a moment and consider just where we stand as to ordnance preparedness.

Much of the equipment required by our Army in war time can be improvised or adapted directly from our civilian activities. The fighting tools of the Army *cannot* be improvised. It is the responsibility of the Ordnance Department to design, procure, and maintain the great bulk of the offensive and defensive fighting equipment essential for our war-time Army. The Army not only must have fighting tools; these tools must be the equal, at least, of those possessed by any other nation. It is fitting tonight, then, that we discuss ordnance preparedness, because if ordnance can be supplied in the time and quantity required, other classes of supplies, with the exception of aircraft and certain other technical items, should present a relatively minor problem.

What are some of the ordnance problems which tend to prevent the supply of fighting tools in the time and quantity required by our prospective war-time Army? First, let us consider design. The age in which we now live is essentially one of speed. Speed has greatly complicated the ordnance problem. Consider the speed of the airplanes of today, as compared with the speed of World War days. Consider our fast tanks, our speedy ships—these are some of the targets our ordnance designs must combat. Problems caused by speed have resulted in the design of high-powered guns and of gun mounts of light construction in order to secure mobility; in the use of light-weight alloys and alloy steels and complicated fire-control equipment. The great advance in airplane construction and the speed now attained by our bombing planes have resulted in a demand for more bombs and for bombs of greater strength and accuracy. Our ordnance designs must meet these and many other similar problems.

Let us now consider design from the procurement standpoint. Our designs not only must give us matériel at least the equal of that possessed by any other nation; they must be of commercial materials and capable of being produced by commercial processes and methods of manufacture. Whether this material is manufactured by a Government establishment or a private concern, economy and speed of production are dependent largely upon the care which has been given to production features of the design. The great bulk of the fighting tools used by the Army in war must come from industry. In ordnance procurement, to use a somewhat time-worn phrase "time is the essence." Certainly we shall not have time even partially to reëquip our industrial plants to manufacture unnecessarily complicated ordnance designs.

I NOW should like to mention Ordnance plans for war procurement. The Department must know what kind of fighting tools will be required and how many of each kind will be required. It must be prepared to make quickly the necessary business arrangements with industry, and finally, it must know where we can get the necessary items in the time and quantity required. These four factors are essential.

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This is an address delivered before the Eighteenth Annual Meeting of the Army Ordnance Association at the Mayflower Hotel, Washington, D. C., May 12, 1937.

Now, as to types of equipment required, we must be in a position to tell industry in understandable language what we want. Our standards, specifications, and drawings cover this feature and I am glad to say that they are in very good shape.

Our plans for making business arrangements with contractors are in better shape than they have been since the Armistice. We realize, of course, that much valuable time can be consumed in negotiating contracts. To obviate this, the War Department has adopted standard War Department contract forms for war use. These forms are revised periodically to keep them abreast of current changes in the industrial world. In making these revisions, full advantage is taken of advice from industry. Our present contract forms are not perfect. They are workable, however, and we hope to improve them as time goes on. The Ordnance Department believes in fair profit for industry, realizing that unless the profit motive is present, production will lag despite the patriotism of both industry and labor. In the event of war, the relatively high-cost producer must come into the industrial picture, as well as the more efficient concern. It has been proposed in Congress to establish a price level beyond which prices for materials and finished items may not rise. Such a price level, if established, must permit the higher-cost producers to enter the picture. Legislation also has been proposed to take away undue profits by means of an excess-profits tax. The Ordnance Department leaves the discussion of excess profits, price levels, etc., to the higher echelons of the Government.

NOW, knowing what kind of fighting tools will be required, how many of each kind will be required, and being in a position to establish quickly business arrangements with industry, the next and perhaps the most important problem is—where can we get the items required in the time and quantity necessary? During the World War it was found that centralized control of the procurement of ordnance was impracticable. The problem was simply too large to permit a centralized organization to function efficiently. Accordingly, the Ordnance Districts were established in 1918. When the National Defense Act was revised in 1920, it provided for the reëstablishment of procurement districts as a definite means of decentralizing the procurement problem. We have worked on this problem now for fifteen years. Apportionments of items have been made to the Ordnance Districts; the districts have fitted these items to the plants best suited to manufacture them. The problem is not solved by any means, but each year we come closer to a practical solution. I believe the Ordnance Procurement Districts will be the salvation of the Ordnance Department in war.

I believe we should be careful about going into too great detail in our procurement planning. Our plans must be flexible and capable of ready adjustment to meet the particular conditions that will exist on M-day because surely the M-day situation will be different from the general situation we have visualized in our planning activities. Our plans must be capable of being fitted to the specific situation that will then exist.

We hear a great deal these days about war and the imminence of war. Conditions in Europe appear to be ripe for a general European war. Whether or not the United States can keep out of such a war, once it starts, is a matter of conjecture. Certainly our people today are firmly against the United States ever entering into another war. However, if you will recall the conditions that existed in 1916, you will realize that the temperament of the people then was much the same as it is to day. In 1917 what had happened? The people were not only ready for war, they demanded that this country enter the war on the Allies' side.

It is safe to say that the United States never will engage in another foreign war unless the people as a whole desire it. If they do, then neutrality laws and laws to regulate war will be of little value against the active desires of the country.

From an Ordnance Department viewpoint, the manufacture and sale of arms and equipment abroad has a decided advantage in that our manufacturers learn from actual experience how to produce, if not our own ordnance designs, then items comparable to them. Ever since 1912, the War Department has approved such a policy, provided secret information about our own matériel is not disclosed to other countries. The recently adopted neutrality law does not prohibit sales to countries at peace by properly licensed manufacturers. Legislation also has been proposed which would lead to the nationalization of munitions manufacture. The Ordnance Department does not favor such legislation because it does not believe that such a policy would work in war and therefore its practice in peace time would mitigate against our success in war time.

FREELY quoting from speeches delivered by our distinguished Secretary, I can say that the War Department and the Army do not want war. Collectively, we hope and pray that there will never be another war. However, each generation of Americans born prior to 1918 has seen at least one war. As practical pacifists we therefore believe that our country should be prepared for war, irrespective of any legislation which may make war less likely to occur.

I now wish to mention what I regard as the most important element of ordnance preparedness: I refer to personnel. Plans for ordnance preparedness, however complete they may be, are worth little more than the paper on which they are written unless they are carried out by capable and energetic personnel. I believe we are particularly fortunate in this respect. Let us consider some of the essential elements of Ordnance procurement personnel. I believe these to be the Ordnance District Chiefs and their Reserve officers; the executives and the directing heads of our great manufacturing concerns; public-spirited citizens throughout the United States; and finally, the membership of the Army Ordnance Association. All four groups are represented here this evening.

The Army Ordnance Association is a common meeting ground for the four elements of personnel essential to ordnance preparedness. The Association is composed of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace. I wish to publicly acknowledge the debt the Ordnance Department owes to the Army Ordnance Association and to its national president, the distinguished World War Assistant Secretary of War and Director of Munitions, Brig. Gen. Benedict Crowell.

There exists no more patriotic and coöperative group of manufacturers than we have in our country. The Ordnance Department is indebted to all you gentlemen for your cooperation in our plans for ordnance preparedness. Again I congratulate you and thank you. Ordnance preparedness is in better shape today than it has ever been, which means simply that industrial preparedness is, as we have known it to be these many years, still one of our strongest guarantees of peace.

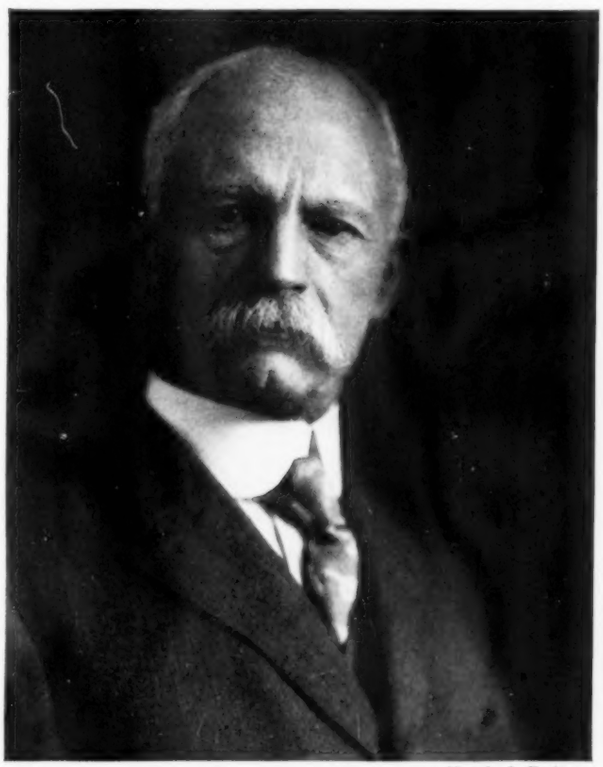
Force in the World of Today

Will Opinion Arrive at a Proper Understanding of its Meaning?

By Maj. Gen. William Crozier*

IT IS with a sense of humility that I admit that this is the first one of these annual meetings of the Army Ordnance Association at which I have been present. In case any of the old friends whose faces I see before me should recall that unimportant circumstance, I want to say in extenuation that this occasion is the first of its kind at whose date I have been in the country.

Although absent from the meetings I have been keenly interested in their significance. I have thought many times of the fundamental object of the Association, which is to promote the readiness of the industries of the country to do their indispensable part in enabling the nation to make effective use of military force upon necessary occasion. Thought along this line has been provoked by the challenge of the Association's object by worthy individuals and organizations who have maintained that the effort of the Association is misdirected and harmful, and that energies would be much better directed toward removal of the causes of war by meeting the grievances of the dissatisfied nations—providing access to raw materials and markets, for example—than toward preparations for waging war, even if in the cause of peace.



Harris & Ewing

MAJ. GEN. WILLIAM CROZIER

Let us look briefly into the world's success in eliminating strife by removal of the causes of disputes. Of course all men and women of good will would love to see established a rule of such justice and evident fairness, and a philosophy of such mutual consideration, that men would no longer be impelled to quarrel or to settle their differences by violence. And we can congratulate ourselves that the efforts of political communities since the beginning of civilization have achieved a degree of success within their respective borders such that many old causes of quarrel no longer arise and many matters are now adjusted peacefully which in older times were occasions of fights between individuals and between subordinate organizations within the state. But if there is anything in analogy, does it not show that since states still must have tribunals for upholding the law and dealing with offenders, and means for the enforcement of the tribunals' findings, there is no hope of avoiding actual disputes in the international field where there exist no supreme law-making, law-interpreting, and law-enforcing agencies with which all states are equipped—at least until we can close our domestic courts, turn the marshals to other pursuits, disband the police force and pension the constabulary?

Other people, all of them well-meaning and some of them thoughtful, urge the ideal of peace preservation through the project of collective security. This is the essential feature of the Covenant of the League of Nations, whereby the power of the disturbed majority of civilization shall be brought to bear in coercion—forceful, if other means prove insufficient—of the peace-breaking nation. The idea has been shown to be abortive; that the failure of the League (and it has failed) to prevent or terminate the aggressive wars of recent years—one in the Orient and one in the Occident—when there was no difference of opinion as to the aggressor, has demonstrated that the use of force to preserve the peace is impracticable and that the idea must be abandoned.

But it is worth while to analyze the subject a little to see why collective security failed, and to judge whether the failure was a necessary sequence of a faulty project. Of course I am thinking particularly of our own country which is not a member of the League and is in no way bound by the Covenant; but there is excellent authority for holding it to be committed to the principle of collective security by the Kellogg Pact. The Pact, by necessary inference, puts all the signatories under obligation to take action to make good their mutual agreement to use only peaceful means in the settlement of their disputes.

Now there is widespread belief that the people of the United States would not tolerate the use of its military forces to prevent warlike settlement of an international dispute in which it should not be directly involved, and I fancy that the belief is correct and that, with the present popular leaning, any administration would seal its condemnation by an attempt to join in forceful coercion of a violator of the Kellogg Pact. But does that popular belief or that leaning end the matter?

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The view that it does end it rests upon the assumption that the popular will cannot be questioned, especially in a free government; that one might as well question the forces of nature, or indict the Rocky Mountains. But if the popular mind cannot be questioned, is it out of the question to change it?

Is it not a familiar practice in our Government by the people, to inform, instruct and lead opinion by educational campaign—propaganda if you like? Some years ago we had an intense educational campaign in regard to silver currency, effective for the moment perhaps. More recently we had the prohibition campaigns; first one way and then the other, and effective in both directions. And time and again we have had tariff campaigns in which the popular mind has been swayed toward higher or lower protection and back again. But what educational campaign has been undertaken with reference to the subject of collective security and any responsibility of the United States to use its great power to help preserve the peace of the world?

There are many societies and associations in this country with the laudable object of promoting the education of our men and women, boys and girls, in international affairs, and they have done much good in their line. Something over a year ago the Digest Press of Washington, D. C., associated with the American University, got out a list of several score of such organizations, with an outline of the program of each; such as the League of Nations Association, the World Peace Foundation, the Federation of the Churches of Christ in America, various institutes of politics, and many others. But, although many of these programs dealt especially with the subject of peace and war, not one of them listed as an item of its activities the inculcation in the minds of the people of a duty to accustom themselves to the idea of support to their Government in the use, upon necessity and with other nations, of its military forces, not to take sides in any dispute, but to compel and enforce its settlement by consultation or arbitrational or judicial means, and not by the brutal and unintelligent method of war.

We have many leaders of thought—men and women, able and high-minded, devoted to the public interest and industrious in its promotion; university presidents; clergymen; statesmen who are unembarrassed by any necessity for being politicians as well—many of whom have the ear of the public and are listened to with attention and respect. We have had volumes of instruction and exhortation, in speech and writing, from these eminent people. I do not care to mention names, but many of them will come to the mind of each of us; and I do not recall an utterance from any one of them extolling the idea of security by collective force as a reserve to be used when all other means have failed, or urging the people to hold themselves ready for the effort and possible sacrifice which may be needed for the great purpose of keeping the peace.

ABOUT five years ago, there was published under the title "Boycotts and Peace" a report of the Committee on Economic Sanctions of the Twentieth Century Fund, in which volume there was, among others, a recommendation that the Kellogg Pact should be revised to include an agreement that the signatories would use all means, *short of force,* to meet a violation of the Pact. This reminds me of a story which General Grant told of himself. His fondness for horses is well known, dating from his early boyhood, and one time, when he was a youngster, he was very desirous of having a promising colt belonging to a neighboring farmer. His father told him that he might buy the colt if the price should not exceed $50, but that he should first offer the owner $25, then $40, and finally $50 if necessary. (I am not certain as to the figures.) Armed with this authority, young Grant went over to the neighbor and said: "Father said I might buy your colt if we could agree on the price, and that I might offer you $25 and if you wouldn't take that, then $40 and finally $50, but no more." It was needless to say, relates the General, what was the price of the colt. If an aggressor is notified in advance that the ultimate sanction of force is not to be employed against him, what is likely to be the effect on his stubbornness of purpose?

Another instance: Several years ago a presidential candidate, in a campaign speech, after expression of an undoubtedly sincere devotion to peace, added that he was opposed to the use of either economic or military coercion to prevent or stop war—either being a form of war and thus implying a negation of purpose. Now about the term "war": is it war when the police force uses its weapons to put down a riot? Was it war when, back in the eighties, the violence of the Molly Maguires was suppressed by the Pennsylvania constabulary?

With such unanimity of avoidance of advocacy of the use of force if necessary, to prevent war, one might almost conclude the idea to be definitely rejected by intellectual America, that humanity changes its nature when it gets into the international field, and that international differences do not need or will not yield to the forceful agencies of peace which no government has been able to do without in its internal affairs. These conclusions might be drawn were it not that so much of the highest intelligence of the world had endorsed the idea at a time when the din of a horrible war was fresh in their ears, and that so much of American judgment probably accepts as final the present disposition of the people to shrink from the assumption of even a part of the responsibility for the maintenance of a peaceful world. Is it to be wondered that the people shrink, left as they have been without guidance from the sources where, for a century and a half, they have been accustomed to look for it, in the control of their public affairs? And do we not get some glimmer of the reason why the "war to end war" has thus far failed of its high purpose?

BUT there are some signs of change. The discussion of the subject of neutrality received a strong impetus some three years ago at the initiative of the Council on Foreign Relations, and the two most prominent and best-informed participants in the discussion, both residents of Washington, each published an analysis of the conditions necessary to be fulfilled if we are to expect to keep out of a major war by a policy of neutrality—the conclusion being that this possibility is so slender that the only safe course is to join in an effort to prevent the war from taking place. But neither of these gentlemen found it appropriate to specifically endorse the use of force to prevent a war.

The advocacy of prevention may spread, and if there shall arise a group with the statesmanship of an Elihu Root and the energy of a Theodore Roosevelt to give to the people a leadership in this great subject which they have heretofore lacked, there may result unanimous opinion that the efforts of the Army Ordnance Association have not been misdirected, and thankfulness that its activities have given effective aid to the preparation of our country to count for something in a really efficient manner in the liquidation of the most dreadful and unnecessary scourge which threatens mankind.

Procurement Planning

The Basis of the New American System of National Defense

By G. M. Barnes*

SO much has been written about the World War that there now exists an understanding throughout our country that in modern war, not only armies, but whole nations are pitted against one another. The military, naval, and air forces merely form the spearhead by which the united effort of the nation is brought to bear against the enemy. Germany, the most efficient military power involved in the last war, had little appreciation of the new character which the war would assume, and visualized one of short duration which would end when her highly trained and well-equipped forces reached Paris. With her adequately equipped military machine, she did not foresee, until considerable time had elapsed, the necessity of mobilizing the nation's industry in its entirety behind the war effort. This came later when the drive on Paris had failed and the unprecedented demands for munitions arrived at headquarters from her armies in the field.

Likewise in this country there was, at first, no appreciation of the extent to which the nation as a whole would be involved in the war. That it finally was realized is shown by the statement made by President Wilson when he said: "The power against which we are arrayed has sought to impose its will upon the world by force. To this end it has increased armament until it has changed the face of war. In the sense in which we have been wont to think of armies, there are no armies in this struggle. There are entire nations armed. Thus the men who remain to till the soil and man the factories are no less a part of the army that is France than the men beneath the battle flags. It must be so with us. It is not an army that we must shape and train for war: it is a nation."

The ever-multiplying importance of munitions during the World War reacted upon the strategical and tactical decisions of the commanding generals of all armies to a constantly increasing extent, until finally the conduct of the war on both sides hinged upon the production and supply of munitions. A few quotations from World War commanders will give some idea of the extent to which munitions controlled operations in the field. On November 16, 1914, Joffre wrote discouragingly: "For two months the lack of munitions has prevented us from extending operations. This situation will last for a long time yet and the longer it lasts the more the enemy reënforces himself, the more he takes the initiative in operations, and the more it will be difficult for us to drive him out of the country." [1]

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A STARTLING lesson for all nations engaged in the World War was the large and unpredicted expenditure of all types of munitions. In the Meuse-Argonne offensive, American artillery fired a greater weight of ammunition than was used by the Union forces during the entire Civil War. What the expenditure of munitions will be in the next great war cannot be predicted, but in the face of past history, it is safe to assume that it will be very much larger than in the last. This tendency toward increased expenditure is already indicated by the post-war development of automatic weapons—many weapons having been speeded up to nearly twice the rate of fire possible in the World War, indicating greater and greater ammunition expenditure.

In the United States in the last war the demands for munitions to equip men as mobilized, and for the supplies required to meet civilian needs, brought practically every manufacturing concern in the country to a peak load. Tremendous problems developed as to how to direct and coördinate this industrial effort of the nation to insure its most effective utilization. The problems, difficulties, and mistakes of the last war have been studied by the War Department continuously, and from these efforts there has evolved the Industrial Mobilization Plan of 1936, which has been written to insure the rapid and orderly mobilization of American industry in another war emergency.

One of the military lessons of the World War for this country was that the man power of the nation could be trained at about 2½ times the rate at which it could be equipped with the essentials of modern armies. Refinements in methods of training may tend still further to decrease the time required to train men for the field. On the other hand, a considerable period of time is necessary to tool up for the manufacture of munitions in large quantities, which naturally is even greater

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The view that it does end it rests upon the assumption that the popular will cannot be questioned, especially in a free government; that one might as well question the forces of nature, or indict the Rocky Mountains. But if the popular mind cannot be questioned, is it out of the question to change it?

Is it not a familiar practice in our Government by the people, to inform, instruct and lead opinion by educational campaign—propaganda if you like? Some years ago we had an intense educational campaign in regard to silver currency, effective for the moment perhaps. More recently we had the prohibition campaigns; first one way and then the other, and effective in both directions. And time and again we have had tariff campaigns in which the popular mind has been swayed toward higher or lower protection and back again. But what educational campaign has been undertaken with reference to the subject of collective security and any responsibility of the United States to use its great power to help preserve the peace of the world?

There are many societies and associations in this country with the laudable object of promoting the education of our men and women, boys and girls, in international affairs, and they have done much good in their line. Something over a year ago the Digest Press of Washington, D. C., associated with the American University, got out a list of several score of such organizations, with an outline of the program of each; such as the League of Nations Association, the World Peace Foundation, the Federation of the Churches of Christ in America, various institutes of politics, and many others. But, although many of these programs dealt especially with the subject of peace and war, not one of them listed as an item of its activities the inculcation in the minds of the people of a duty to accustom themselves to the idea of support to their Government in the use, upon necessity and with other nations, of its military forces, not to take sides in any dispute, but to compel and enforce its settlement by consultation or arbitrational or judicial means, and not by the brutal and unintelligent method of war.

We have many leaders of thought—men and women, able and high-minded, devoted to the public interest and industrious in its promotion; university presidents; clergymen; statesmen who are unembarrassed by any necessity for being politicians as well—many of whom have the ear of the public and are listened to with attention and respect. We have had volumes of instruction and exhortation, in speech and writing, from these eminent people. I do not care to mention names, but many of them will come to the mind of each of us; and I do not recall an utterance from any one of them extolling the idea of security by collective force as a reserve to be used when all other means have failed, or urging the people to hold themselves ready for the effort and possible sacrifice which may be needed for the great purpose of keeping the peace.

ABOUT five years ago, there was published under the title "Boycotts and Peace" a report of the Committee on Economic Sanctions of the Twentieth Century Fund, in which volume there was, among others, a recommendation that the Kellogg Pact should be revised to include an agreement that the signatories would use all means, *short of force,* to meet a violation of the Pact. This reminds me of a story which General Grant told of himself. His fondness for horses is well known, dating from his early boyhood, and one time, when he was a youngster, he was very desirous of having a promising colt belonging to a neighboring farmer. His father told him that he might buy the colt if the price should not exceed $50, but that he should first offer the owner $25, then $40, and finally $50 if necessary. (I am not certain as to the figures.) Armed with this authority, young Grant went over to the neighbor and said: "Father said I might buy your colt if we could agree on the price, and that I might offer you $25 and if you wouldn't take that, then $40 and finally $50, but no more." It was needless to say, relates the General, what was the price of the colt. If an aggressor is notified in advance that the ultimate sanction of force is not to be employed against him, what is likely to be the effect on his stubbornness of purpose?

Another instance: Several years ago a presidential candidate, in a campaign speech, after expression of an undoubtedly sincere devotion to peace, added that he was opposed to the use of either economic or military coercion to prevent or stop war—either being a form of war and thus implying a negation of purpose. Now about the term "war": is it war when the police force uses its weapons to put down a riot? Was it war when, back in the eighties, the violence of the Molly Maguires was suppressed by the Pennsylvania constabulary?

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than that consumed by industry in changing from one model to another of its own specialty. Manufacturers in time of peace have little or no opportunity to learn how to manufacture munitions, and today there is no appreciable munitions-export business in the United States. Fortunately, however, there are means of shortening and making more predictable the time from the start of mobilization until production becomes effective, as will be developed later in this article.

TODAY we are confronted with the spectacle of the vast rearmament programs of Germany, Russia, and Italy, all of which nations are busily engaged in building up great stock piles of munitions. The magnitude of these stock piles indicates that it is planned to equip a large proportion of the man power of the nation within a few days after the government decrees that the mobilization shall begin. Great Britain and France have viewed these warlike preparations with alarm and have been compelled to follow suit. Great Britain's resulting rearmament program was outlined in the White Paper of March 3, 1936. Recent newspaper accounts have kept the American public informed as to the trend of this program, and the recent statements in the press give us an idea as to the tax burden which will be imposed upon the citizens of England. Yet England feels, and doubtless rightly so, that this procedure is the best possible insurance against another World War and the only one left open to her.

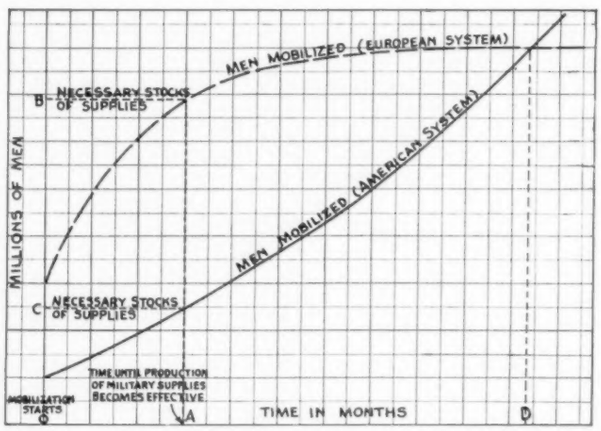

Fig. 1. Typical Mobilization Diagram

The fact is that these European nations lie so closely together that the armies of one nation can, within a few days, engage those of another nation. This system of having the equipment for several million men ready at a few days' notice may be called the European system of preparation for war, since it is the one which is now being followed by the great European powers. This system, while it is necessary for a country like England as long as the political situation exists as it is today, has, however, serious disadvantages from the American standpoint. One important disadvantage is its prohibitive cost: Great Britain, during 1937, will spend eighty million pounds on its rearmament program and the amounts being spent by Germany, Italy, and Russia will be as great or greater.

The manufacture, in peace time, of great quantities of munitions, requires the diversion of a disproportionate part of the industrial capacity of the country for the production of goods having no economic value. This seriously interferes with the peace-time commercial pursuits of the nation, and if continued over a sufficient number of years, would be bound to point toward economic disaster. Such a program could not be considered wise for this country, as the technical supplies of war are constantly being changed and refined. It would now be possible for us to replace practically every type of weapon which we used in the World War by ones of greater efficiency, if this were considered necessary and funds were available for the purpose. The military airplane of today will be considered almost useless a short time hence, just as the tank of the World War with its speed of three to five miles an hour would not be considered suitable equipment as compared to tanks of recent development capable of speeds of from twenty to fifty miles an hour. The tremendous costs of maintaining a large stock pile due to obsolescence and deterioration must also be considered.

FOR years it has been considered necessary by many military men that the United States follow the policies of the principal countries of Europe in matters pertaining to war. There has been the thought that if some first-class European power considers it necessary to have several thousand modern tanks, the United States should also, in general, follow this lead; or that if one country manufactures a large number of bombardment airplanes, a corresponding number should be available here.

Since the close of the World War, this conception has been changing gradually. There has been evolved an American system of national defense based upon the realization that our defensive method should be one which is suited to our national military policy and to our strong strategic situation. Our national policy is one of defense and does not contemplate any offensive operations, save as may be necessary in furtherance of our protection. Our strategic position, coupled with our great natural resources, outstanding industrial strength, and our almost limitless man power, has allowed us to develop a new system for national defense which is basically different from that used in Europe today and which is distinctly American in character.

Large unfordable rivers and mountain chains still form important obstacles to military action. By comparison, how vastly greater is the protection afforded this country by the Atlantic and Pacific Oceans. There is no nation on the American continent which could seriously oppose this country in war, and any combination of powers which could successfully wage war with the United States would be compelled to bring its armies over great sea distances. As far into the future as we can look today, these oceans will continue to afford us protection. In any situation which can be envisaged, assuming the most pessimistic case—that our fleet is destroyed—a period of time must elapse before armies can be brought in force to our shores, and time is of the essence in war.

The European system defined above is based upon the fact that the nation cannot wait for industry to produce the necessary military supplies, and that therefore stock piles of munitions must be available when the orders for mobilization are issued. This will not be true in any situation which can be foreseen involving the defense of this country. The time factor will permit of the orderly mobilization, not only of men, but of industry for the production of the necessary equipment. Thus the seas provide us with a time factor which changes the complexion of our system of national defense and makes it radically different from that which is necessary for England or any other European power. While it may be impossible to prevent absolutely isolated raids by aircraft or surface ships

against our shores, the oceans are an effective deterrent to attacks in force. Such attacks would require an enemy to spend considerable time for preparation. The importance of this delay before the arrival of large bodies of armed forces cannot be overstressed. This makes possible a sound policy of national defense with the expenditure, in time of peace, of relatively small amounts of money. It permits us to substitute moderate stocks of munitions for the great stocks of supplies necessary for European nations not so fortunately situated and less well endowed with basic raw materials and commercial industries.

The differences between the European and the American systems may, perhaps, be better understood from an examination of the diagram (Fig. 1). The upper curve shows a typical mobilization of man power as a function of time, such as might be used by a European country after the outbreak of hostilities. Assuming that *OA* represents the length of time required from the start of mobilization until the production of military supplies by the country's industry becomes effective, then *OB* would be proportional to the quantity of military supplies which must be on hand for the large number of men mobilized, since, of course, the larger the number of men, the more supplies of all kinds which are necessary to equip these men. The lower curve might be a typical mobilization for the men to be mobilized under our system.

Since there is no necessity for having available immediately the large number of men shown in the upper curve, time is available for the more orderly process of mobilization of man power and economic resources. For our country guarded by the retarding seas, the slower mobilization is possible even though the number of men to be mobilized eventually might be very much larger than in the case of the European nation visualized. It is therefore possible to have a very much smaller stock pile of supplies (*OC*), since after period *OA* men can be equipped from new production as fast as mobilized. The difference in the cost of the stock of munitions required to equip the men mobilized in accordance with the upper curve, and that required in accordance with the lower curve, under the so-called American system, will represent a difference in cost to the taxpayers of the country of billions of dollars, and yet for the smaller sum we are able to have a sound system of national defense.

IF we are to be able to equip the large number of men which may finally have to be mobilized (Fig. 1: time *D* or later), starting with modest stocks on hand (as represented by line *OC*) there must be an assurance beyond question of doubt that the needed supplies (after time *A*) will be available for the troops from new production. The science of insuring that these supplies will be available in the time and quantity needed is a distinctive American development known in its entirety as "Industrial Mobilization," and that part of industrial mobilization pertaining to the peace-time planning for this assurance of adequate supplies is called "Procurement Planning." It is the objective of the writer to describe briefly how, by this peace-time planning, the nation can be assured that its armies will be adequately supplied and equipped in war.

Procurement planning presupposes that the general scheme for the mobilization of the Army has been decided upon. It is not necessary that every situation which might arise be visualized, but only that the most unfavorable one which may occur be used as the basic plan. In other words, it is desired to assume a situation which will produce the largest demands for supplies which can be foreseen under any practical situation. To make certain that the supplies will be available to meet the requirements of the men as mobilized, it is necessary that a separate plan be written for each item for which any difficulty in procurement, in case of an emergency, will arise. In writing these item plans, the following data must be secured to furnish satisfactory answers to these basic questions: (1) What is wanted (specifications and drawings)? (2) How many of each item are needed; that is, how many must be manufactured each monthly period? (3) Where can the item be procured? When can deliveries begin and at what monthly rate can the item be produced?

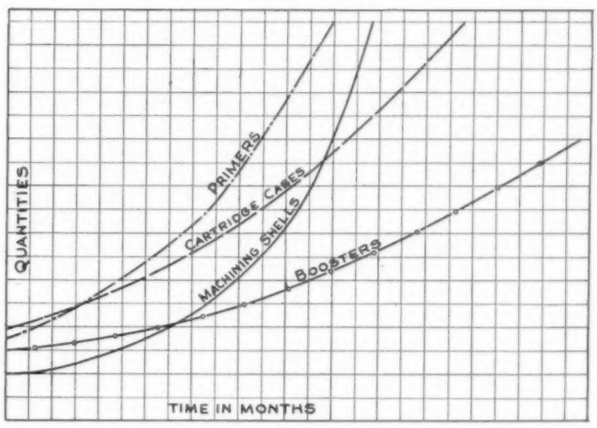

FIG. 2. TYPICAL DIAGRAM SHOWING METHOD OF CHECKING THE COÖRDINATION OF PROCUREMENT OF COMPONENTS OF A MILITARY ITEM. CURVES SHOW STOCKS PLUS EXPECTED PRODUCTION OF EACH ITEM

What is wanted? In the last war the War Department found that it was necessary to buy some 700,000 different items in order to maintain its armies in the field. A large proportion of these items was, of course, commercial, and the procurement of these was comparatively simple. There was also a large number of technical military items entirely unknown to the commercial world. Before procurement from industry of an item can be initiated, it must be clearly identified by drawings, specifications, or both. In the case of military supplies of a noncommercial and technical character, complete and detailed drawings specifying tolerances must be prepared before manufacturers can undertake production. It is, therefore, necessary in time of peace to study continuously all the items which are used by an army, with particular reference to technical items, and to plan that drawings and specifications satisfactory to commercial concerns will be available immediately upon the outbreak of hostilities so that no time will be lost in starting industry on its way along the road toward quantity production.

While the Assistant Secretary of War has been charged in the National Defense Act with the duty of the supervision of procurement in peace and war, the actual procurement of the needed supplies is performed by the eight supply arms and services. The supplies which each chief is called upon to procure have been cleverly divided among these several technical supply branches; for example, the Chief of Ordnance buys only ordnance matériel; the Quartermaster General, food,

clothing and other commercial supplies; the Surgeon General, medical supplies; the Chief Signal Officer, communication equipment, etc., so that there is no important overlapping between them in procurement. This division of technical supplies allows these procurement agencies to become expert in the design, development, and procurement of the supplies with which they are charged.

The procurement of technical military supplies is a very difficult and complex problem because of the intricate nature of the implements of modern warfare. Most commercial manufacturers are not acquainted with the manufacture of military equipment and often are not equipped to manufacture a complete item, but can only produce one or more components. It is, therefore, not always possible to base procurement plans upon the items which are supplied to the troops as items of issue, for the reason that the supply arms and services are compelled in many cases to subdivide an item when placing orders. Thus the Ordnance Department does not procure a complete round of 75-mm. high-explosive shell, but must procure primers, cartridge cases, propellent powder, shell forgings, the machining of shell forgings, high explosives, metal components of fuzes, the loading of fuzes, the loading of shell, and the assembly of complete rounds of ammunition. It is also necessary to procure many items which are never issued to troops but which are essential to the manufacture of munitions—such as gages. Therefore, in procurement planning it is necessary to depart from the items with which the armies in the field are directly concerned and to plan for the items or parts of items as they will be produced by industry.

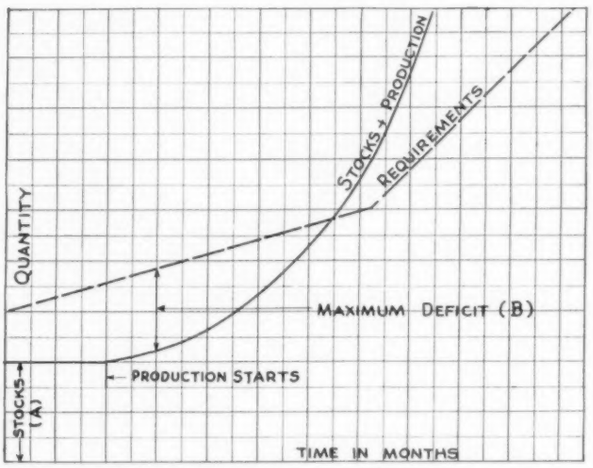

FIG. 3. TYPICAL DIAGRAM SHOWING METHOD OF CHECKING RESERVE STOCK OR MOBILIZATION PLAN. ITEM SHOWN IS THE 75-MM. GUN. WAR RESERVE IS *A* PLUS *B*

These military supplies are constantly being changed and improved, so that the process of keeping the drawings and specifications up-to-date must be a continuous one. This work forms one of the most important peace-time duties of the chiefs of the several services, for if these data are not immediately available in an emergency, the whole fabric of our system of industrial mobilization is endangered.

How many of each item are needed? If a plan is available for the mobilization of the nation's man power, it will furnish a basis upon which the quantities of supplies needed by the Army month by month can be determined. When this country declared war in 1917, no mobilization plan existed upon which the requirements of supplies could have been based, and the requirements were therefore unknown. It was necessary to take time to compute them before steps could be taken toward procurement. No contracts can be placed with industry in war until the War Department knows what it wants as determined by drawings and specifications and the quantities needed monthly. Since the Army prior to the World War did not have any well-established methods for determining the quantities of supplies required, it was necessary in the haste and the vast inexperience of war to devise them.

It would seem a relatively simple matter to determine the quantities of supplies, provided data were available as to the requirements of each type of organization. The matter is not quite as simple as this, since in addition to the initial issues of supplies to organizations, allowances must be made for losses in the field and for the wearing out of equipment, and factors must be introduced to allow for the time required to transport supplies from places of manufacture, through the depots of the supply system, and finally to the organization or men in the field. These computations were further complicated during the World War by the fact that in most cases old allowances were found to be wholly inadequate under modern battle conditions. Ammunition expenditure rates increased ten times in the period between the first and last months of the war. It is not contended that no errors were made in the computation of requirements during the World War or that unreasonable surpluses did not result from unwise manufacturing programs, but if the war had continued for another year or more, as was expected, the same requirements in the main would have been considered correctly determined, as most of the surpluses would have been wiped out. In war, it is much better to have surpluses than shortages.

THE organizations now exist for determining exactly what will be bought, and in what quantities, and if errors are made, and many will doubtless be made, they will be due to changes in conception as to what should be furnished after the emergency occurs. It is held by some authorities that little is gained by determining what and how many are needed in time of peace because as soon as war comes, new equipment will be used, quite different from that which can be visualized in peace. Many examples of the development of new weapons in the last war can be cited. The airplane had not been used to any extent as a military weapon up to 1914, but during the war it developed rapidly and became a very important military tool. Great difficulties were experienced in the manufacture of this undeveloped machine, and builders could not keep up with the demands, for almost as soon as a machine was completed it was obsolescent and there were demands for a later type.

The tank, another product of the war, was at first a very crude and clumsy machine. Its usefulness was limited by the mechanical unreliability of the machinery in its then undeveloped state. The Germans suddenly introduced poison gas which turned out to be less effective than it otherwise might have been, as the Germans did not realize its correct tactical employment. These are examples of new weapons which appeared or were largely developed after the war started. They were all auxiliary tools and none of them had a decisive influence upon the war. The war was largely fought with the weapons which had been developed up to the

time the war started. No more important peace-time function exists for the Regular Army than the development of its weapons year by year and the completion of the drawings and specifications of the weapons as they are developed, together with the determination of the quantities which will be needed.

That there will be many new weapons developed in the next war is certain, because in an emergency unlimited funds, together with the urgent necessity for new weapons, bring about their rapid development. Nevertheless, the first year of the next war will, in the main, be fought with the types of weapons in existence at the start, and the new and now unknown tools of war will not begin to appear on the battlefield until many months have elapsed.

Where and at what rate can the item be procured? After the War Department has completed its work of finding out what items and how many of each item are required, it is then in a position to approach industry to determine where and at what monthly rate such supplies can be obtained. Notwithstanding the efforts now being made by some groups in this country to nationalize the munitions industry, it should be clear to anyone who studies this question that it will never be possible for the Government to manufacture its munitions in war in Government establishments unless it nationalizes American industry in its entirety. In the last war our Government arsenals, although expanded to the utmost, could furnish but two per cent of the needed military equipment, and so it will be in the next war. Maj. Gen. William H. Tschappat, Chief of Ordnance, in an article "Present Ordnance Problems" published in the September-October 1936 issue of ARMY ORDNANCE (Vol. XVII, No. 98, pp. 71-72), sets forth the true functions of Government manufacturing arsenals in war. He points out that American industry must be relied upon to produce the bulk of munitions after M-day.

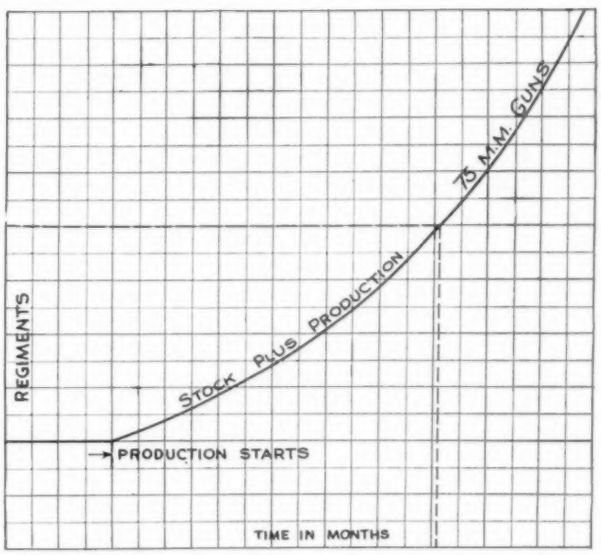

FIG. 4. TYPICAL DIAGRAM SHOWING METHOD OF PREDICTING THE TIME REQUIRED TO EQUIP A SPECIFIED MILITARY FORCE

Soon after war was declared by Germany in 1914, it was appreciated in this country that the help of industry would have to be secured in case of war in order to find out what they could furnish and what firms would be best adapted to manufacture different types of equipment. The Secretary of the Navy directed that a survey of industry be made and appointed the Naval Consulting Board. This board made a survey of industry in a relatively short time, listing some 18,000 firms for the use of the Government in placing contracts. Unfortunately, at the time it was not known how to make an industrial survey, and the data collected were of little practical value.

Today it is known that a successful survey of industry only can be made on an item-by-item basis, and that the War Department must bring information to industry as to the item, identified by drawings and specifications and the quantity of each item required. This survey of industry by the War Department has been in progress almost continuously since the World War, and there probably exists in this country a more complete knowledge as to how to convert our commercial industry into one for war than in any other country in the world. It is apparent that this survey, in order to be of any value, must be continuous, as commercial concerns not only change, expand, go out of business, or add new facilities, but the items which the War Department wants are also in a continual state of evolution. After the groundwork has been laid, that is, after the firms have been surveyed and the ones best adapted for the manufacture of each type of munitions have been discovered, the work of keeping such records up-to-date is less arduous.

One more step could be made which would make the assurance of supply still more certain, and that would be the placing, in time of peace, of small orders with the firms selected for the manufacture of specified items in time of war—the so-called "educational orders." While the War Department has endeavored over many years to obtain the necessary authority from Congress to place such orders in time of peace, the necessary authorization has not yet been secured. However, the War Department does place in the hands of manufacturers drawings and specifications of the items which they are expected to produce. The manufacturer, in turn, studies the drawings and tells the War Department how many he estimates his company can produce monthly and when deliveries can start.

Some manufacturers have gone further than this and have made factory plans showing layouts of machines and studied the additional new machinery, buildings, and equipment necessary for manufacturing or for increasing production, and have done much of the preliminary work which would be necessary prior to initiating manufacture in war. All of this work by thousands of manufacturing concerns throughout the country has been done from patriotic motives, without any payment from the War Department. The efforts of the War Department to insure that the best use will be made of American industry in war have received the unqualified support of American business.

When all the data referred to above shall have been completed, that is, the drawings and specifications identifying the item, requirements, or the number of the item necessary month by month, the survey of industry showing which manufacturers are most capable of manufacturing the item, and the monthly rate at which they can produce it, this information can be assembled together into what is known as a "procurement plan," for that item. Procurement planning is, therefore, the obtaining and recording of vital procurement data for all the principal items which will be required for the Army in time of war. It is a peace-time function.

As was stated previously, it is not always possible to purchase complete items, but it is necessary to have various companies manufacture the several components. Care must be taken that the plans for these components are coördinated. Fig. 2 shows the method of determining that the various component plans have been coördinated as to time and quantity. Curves are plotted to indicate stock on hand plus expected monthly production. By such diagrams choke points can be discovered in time of peace.

It can be determined with considerable accuracy what items or components of items will lag behind in manufacture, and armed with this information, steps can be taken in time of peace, either by changes in design or by increasing the number of manufacturers, to step up the production of the items or components which are out of phase with the others. Such coördination studies based upon the results of procurement planning will result, if carefully analyzed, in balanced production and will eliminate shortages in vital items or components of such items which might have serious effects upon the military effort. In the last war, such a situation occurred when it was found that boosters, a component of high-explosive shells, fell far behind the other shell components in production. If this situation had been analyzed by procurement planning in peace it could have been remedied either by modification of design of the booster or by change in plans for production, so that the whole program of complete rounds of artillery ammunition would not have been delayed.

Similar diagrams can be drawn, after procurement plans have been completed, of interrelated items manufactured by one or more supply arms and services. For example, such analysis can be made to see whether the radio sets manufactured by the Signal Corps are keeping pace with the tanks manufactured by the Ordnance Department, in which they will be used, or whether the machine guns manufactured by the Ordnance Department are in step with the airplane programs of the Air Corps.

The problem of supply also can be worked backward, using the results of procurement planning to determine in peace time whether a mobilization plan which has been decided upon by the military authorities is feasible from the standpoint of supply. This situation is illustrated in Fig. 3. Based upon the Industrial Mobilization Plan, the requirements of the item can be plotted month by month, and on the same diagram a curve showing stocks on hand of the item under consideration plus expected production can be drawn. If there is a deficit between the curve showing stocks on hand plus production and the curve for requirements, the maximum deficit will indicate the amount by which the existing stock should be increased in time of peace to insure that no deficit will exist in this item in a war emergency. Instead of increasing the stock, it may, of course, be possible to improve the production of the item by improvements in design or by adding new facilities, so as not to require the expenditure in time of peace of additional funds for stock.

From the standpoint of cost, it is very much better to overcome these deficits discovered in peace by changing the design of the item, if possible, so as to permit more rapid production, or by more complete planning, than by increasing the war-reserve stocks. When, however, all possible steps in procurement planning have been taken and deficits still remain, then a sound basis exists upon which to base further expenditure of funds for reserve stocks. Under the American system, the desire is to keep the stock piles (Fig. 3: *A* plus *B*) as low as possible, since these stock piles cost money, are yearly deteriorating, and becoming obsolescent. It may be also that the mobilization plan upon which the requirements are based is unreasonable as to time, or man power, or both, and that the plan must be changed if excessive stocks are to be avoided.

After procurement plans have been completed, diagrams like Fig. 4 can be drawn for each important item of equipment (75-mm. guns, for example) showing stock on hand plus expected production. From such a diagram it can be predicted in time of peace how many months the Army will have to wait after mobilization until it can have the desired number of artillery regiments equipped with 75-mm. guns for its armies. If the conditions shown by these diagrams do not meet the needs of the stragetic and tactical plans of the country, then steps can be taken in peace to correct the deficiencies which it can be foreseen will exist in war.

REFERRING again to Fig. 1, the time from the start of mobilization until production becomes effective is the critical period during which troops can be supplied only from the storehouses. It follows, therefore, that all measures which can be taken to assure the earliest possible production of adequate supplies are of the greatest importance. It is this time which determines the quantities of reserve supplies, and the more this time can be decreased, the smaller will be the stock piles of required munitions. It will likewise be appreciated that the system for national defense, built up on the basis of maintaining modest reserve stocks of supplies, fails unless adequate production of supplies materializes in the time and in the quantities needed.

Procurement planning, as has been set forth above, provides that all possible steps be taken in peace to insure that this production will materialize as planned; that is, by having drawings and specifications ready so that the item is fully identified to industry; by knowing how many of each item are required month by month so that valuable time will not be dissipated in manufacturing unnecessary equipment; by knowing what facilities in the United States are most capable from the standpoint of management and shop facilities to undertake the work; by giving them the opportunity in time of peace of studying the drawings and specifications so they may have a good idea of what will be required of them; and finally by obtaining from them the best peace-time estimates as to the rates of production.

While years of hard work have been required to make the necessary surveys of industry and to assemble and evaluate the data required by procurement planning, the War Department is now in a position to predict accurately what is and is not possible in war from American industry. If proper cognizance is taken of the facts disclosed by these procurement plans, there need be no disappointments and disillusionments in the next war in the supply of vital munitions for our armies in the field.

EDITOR'S NOTE: This is the third of a series of articles on the peace-time development of plans and policies of industrial mobilization written by officers of the Planning Branch, Office of the Assistant Secretary of War. The first article of the series, "Army and Navy Munitions Board" by Col. H. W. T. Eglin was published in the March-April issue of this journal. The second, "Standards for Army Supplies" by Capt. George V. McPike, was published in the May-June issue. Others, on related subjects, will appear in the next and succeeding issues.

The Tanks at Cambrai

The Maxims of Battle Are Not Changed by Mechanization, I

By Fred. H. Wagner*

IN MY previous articles on tanks which appeared in this journal, I endeavored to emphasize my opinion that tanks were *weapons of opportunity,* and I know of no better example of opportune use than their employment in the battle of Cambrai. Unfortunately, the results obtained by the tanks in this battle were not later consolidated, and after sacrificing these new weapons, the entire operation ended in defeat.

The year 1917 saw the Allies on the offensive in all theaters of the war, but they were rudely awakened from their feelings of satisfaction thereat when the rumblings of a mighty storm began to be heard amidst the peaks of the Julian Alps; the results which followed the breaking of this storm dispelled all Allied hopes for a rapid victory.

Italy had been valiantly attacking her Austrian foes during August and September, and the impression had become current that the tide of battle was definitely flowing in her favor. The Italian offensive had had an ill effect on the war-weary Austrians, who became convinced they could no longer withstand the continuous attacks on the Isonzo front.

Marshal Hindenburg was of the opinion that Italy soon would compel Austria to make a separate peace unless German arms came to her aid. He consequently decided to launch both a strategical and tactical offensive against Italy with the hope that its success would turn the tables and cause Italy to make a separate peace. He therefore ordered Ludendorff to prepare plans for the offensive.

Psychology played quite an important rôle in Ludendorff's plans for this offensive. He immediately started a campaign at the front through fraternization, and in Italy through the German psychological department, to fix the Italian soldier's mind on the thought that it was a sin to kill his brother. The Italians were told they were brothers of the Austrians, hence if both refused to fight, the war would soon be over so far as they were concerned. After this campaign was well under way, Ludendorff planned the reduction of the Udine salient by a surprise attack which was destined to destroy the Italian armies. This psychological campaign met with success: there was an insistent demand in Italy for a separate peace, while at the front many Italian soldiers fraternized with the Austrians and agreed to stop fighting. Thus was the first part of Ludendorff's plan completed.

The second part was inaugurated on October 24, 1917 when, at 2 A. M., Von Bülow launched his attack preceded by heavy artillery preparation and asphyxiating gas. It is unnecessary to give an account of the ensuing debacle; suffice it to say that the end was not until the Italians had been routed, fleeing in a demoralized state to the Piave River-Mont Grappa-Lake Garda line.

The tables were now turned. The Allies feared that Hindenburg's expectations had been realized and that Italy would be compelled to make a separate peace with the Central Powers; hence something drastic had to be done to avoid this. Italy previously had sought aid from the Allies but this had been refused. The battle of Caporetto, however, opened the eyes of the Allies to the situation, and British and French troops were sent to Italy to bolster up the opposition.

Further assistance was needed however. Consequently Marshal Haig decided that a strong offensive launched against the Germans would pin them down and necessitate the holding of all German troops on the Western Front, thus withdrawing any additional assistance from the Austrians in their campaign against Italy. A *surprise* attack with tanks at Cambrai was finally proposed and was received favorably by Haig. The plan was finally sanctioned and the attack was ordered to begin on November 20, 1917.

THE recent inferno in Flanders had exhausted the German troops to quite some extent; hence those which had taken part in these battles were withdrawn and sent to a "quiet" sector where they were to recuperate and drill the replacements. Cambrai was considered as lying in such a front. The terrain was mostly flat with some hills less than 300 feet high; there were quite a number of villages in the sector and the surrounding fields had been intensively cultivated; otherwise there was very little natural cover except directly in front, where some forests were located. The position was a part of the Hindenburg-Siegfried line, to which the Germans had retreated during March 1917.

An outpost trench system marked the first German line, the front of which was protected with a broad band of wire entanglements. The forward zone behind this first line had a depth of between 1000 and 1100 yards to the first battle trench and contained numerous wired strong points. The first battle trench had a width of about 9.5 feet and was protected by another broad band of wire. It was provided with excellent primary strong points commanding the field and was supported by numerous secondary points. The second battle trench lay between 220 and 330 yards behind the first and was arranged in a similar manner, including the front band of wire entanglements, both about 33 yards wide. Communication between these was established through numerous connecting trenches. This system embraced the first position.

The second position was some 2200 yards behind the first. This also consisted of two battle trenches protected by broad bands of wire, but was not entirely completed at the time of the battle. Communication with the first position was by means of several covered passages.

The 54th Infantry Division, with a front of about 6.5 miles, was in position between Havrincourt and La Vacquierie. Two battalions of each of the three regiments were in the trenches, the third battalions at rest to the rear. During quiet days, the first position only was occupied, the second being empty. Each battalion had a front of a little more than one mile and a depth of approximately the same. The fourteen batteries of the division artillery, about fifty guns, were distributed in Graincourt, Flesquières and to the north of Marcoing.

On November 18th several prisoners were taken by the

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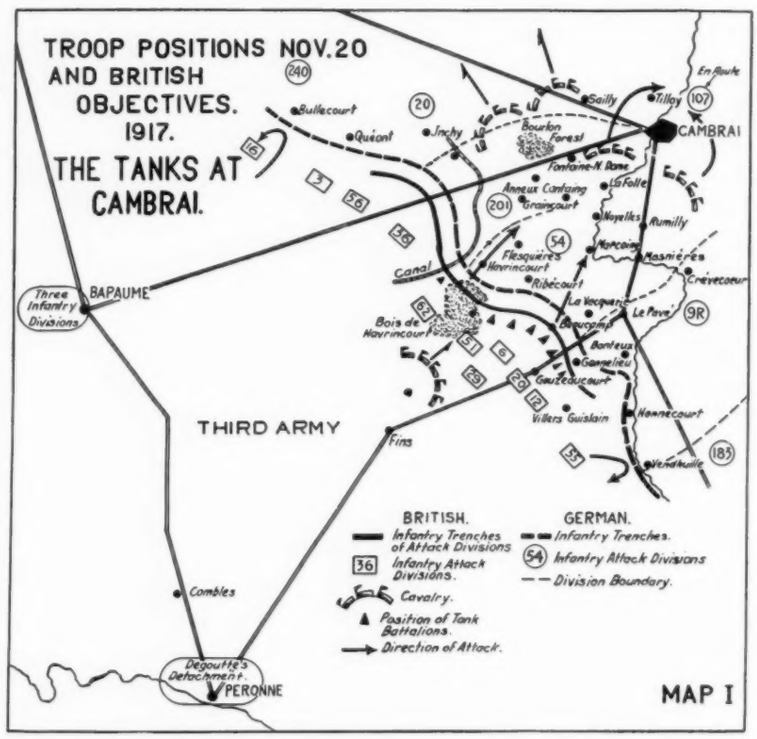
Germans, and from one of these it was learned that a heavy attack would be launched by the British on November 20th against Havrincourt and that fresh troops and tanks had arrived in the British lines for this purpose. The Germans were also informed that the attack would be preceded by an artillery bombardment of several hours duration.

The contemplated attack was, therefore, not a surprise, but the mass tank offensive which accompanied it surely was. This information caused the German commander to make the following disposition of the forces at his disposal: Since Havrincourt was in the 54th Division sector, the division would occupy the front with one regiment; the battalions at rest in the rear were ordered to the intermediate position. The 27th Infantry Reserve Regiment, from the sparse reserves available, was assigned to the 54th Division; this was to be employed as a shock regiment, and it was placed in and to the rear of the intermediate position.



The 107th Infantry Division had just arrived at the scene, and a portion of its artillery was attached to the 54th Division; these guns took position at Graincourt and Flesquières. All possible defensive measures were taken on the night of the 19th, not only by the 54th Division, but also by its neighboring ones. Everything had been done which the lessons learned during the past three years indicated as necessary, but the character of the British attack was something new and for which the Germans were not prepared.

The sector to be attacked lay in the British Third Army area, and General Haig planned to have this army, which was under the command of General Byng, penetrate the German lines in the direction of Cambrai. The essence of the attack was to be *surprise*, but the British failed to realize that surprise was a two-edged weapon which could cut both ways. Penetration was to be exploited by cutting the German lines of communication, which were only about eight miles distant.

Haig estimated that forty-eight hours would be required to bring about a successful issue; he also felt that this length of time would be required for the Germans to bring up reenforcements. Consequently he ordered the infantry, tanks, and artillery to penetrate the German lines on the first day. This was to be followed by the penetration of the second and third lines, after which the British cavalry was to pass through and cut the German railroad communications in the neighborhood of Cambrai. Since surprise was the essence of this operation, Haig's orders were communicated in strictest confidence to the few who were actually conversant with the plan; hence only British superior officers and the French High Command were informed of the contemplated action.

Disposition of the troops, as well as reconnaissance and artillery fire on the front line, were not to be changed before H hour, and the necessary increase in circulation due to the movements of the fresh troops with their transport was to be accomplished only under cover of darkness. The fresh batteries entering the operation were forbidden to register, and all troops intended to take part in the attack received special training and rehearsals behind the front, the training terrain selected being somewhat similar to that of the front to be attacked.

The French sent two infantry and two cavalry divisions, under General Degoutte, to Peronne, where they were to report to General Byng—Degoutte himself being unadvised of the intended operation. These French troops may just as well have been left at home since, unfortunately for the British, they were never employed in the battle.

Haig also provided a special reserve of three infantry divisions at Bapaume for the purpose of rolling back to the north the inner flank of the German right wing after it had been dislocated.

THE attack was to be assisted by three tank brigades consisting of three battalions of three companies each; each company embraced four sections of four tanks, which, with the command and auxiliary tanks, were reported to have made a total of 476 of these new implements of warfare. The greater portion of the tanks had been withdrawn from the Ypres and Arras fronts and were assembled shortly before the day of the attack.

These were Mark IV tanks, each manned by eight men and weighing about thirty tons. The male tank was armed with two 6-pounder cannon and four machine guns, while the female tank carried six Lewis machine guns. The armor varied in thickness from 0.2- to 0.47-inch. Provided with Daimler 6-cylinder, 125-horsepower engines, the tanks had a maximum speed of about 3.7 miles an hour with a fuel capacity of 75 gallons.

It is reported that between eighty and one hundred of the tanks were trained at La Flaque, where old trenches gave a semblance of the real terrain of the operation, for a period of eight days. The tank crews were trained in conjunction with infantry, but unfortunately not always with the troops of the

divisions which were to take part in the attack. The 2nd Tank Brigade, consisting of battalions A, B and H, had been assembled in Dessart Forest on the night of November 18th, and during the same night A battalion proceeded to its concealed lying-up point. On the 19th, between four and five o'clock, B and H battalions started for their points in the vicinity of Villers Plouich and Beaucamp. The distance to be traversed in this movement was about 4.5 miles, each battalion having a different march route. The Germans later expressed the opinion that this was too long a march for Mark IV tanks, and that they probably failed to reach their destination in the best condition, but this could not be avoided since no other concealed lying-up points were available in the vicinity of the starting points.

In order to avoid damage to the telephone and telegraph wires, one man was stationed on the top of each tank for the purpose of lifting these wires to allow the tank to pass under them. In complete darkness, combined with the necessity of lifting these wires, the tanks proceeded but slowly to their destination. Further delay was occasioned by the danger of losing the fascines carried on the front of each tank. H battalion reached its designated point at 1 A.M. and B at 3 A.M., but the Germans remained in utter ignorance of the movement.

The infantry concentrations were inspected on the night preceding the battle, and infantry guides were assembled at brigade headquarters. Upon arrival of the tanks, the group commanders reported to headquarters where the guides were assigned them, these guides leading their infantry section to the tanks.

The missions given the tanks were: (1) cutting paths through the German wire to permit the infantry advance; (2) a tank wave about 500 feet ahead of the infantry was assigned the task of pinning the Germans in their trenches by paralleling the latter until the infantry had passed the wire; (3) the main force of tanks, accompanied by infantry, was then to assist in breaking German resistance in the trenches. A similar operation was to take place at the neighboring villages. A special detail of tanks, without infantry support, was to take and occupy the bridgeheads at Marcoing and the heights of Bois des Neuf and Premy Farm, and to hold on until the arrival of infantry.

The assembly point of a portion of the tanks was at Gouzeaucourt, from where they proceeded to the jumping-off point between Bois des Havrincourt and Villers Guislain under their own power. All movements were made at night and lights or fires of any kind were prohibited. The concealed and waiting tanks were camouflaged and covered with nets to avoid detection from the air, and those which could not be accommodated under trees were covered with earth-colored tarpaulins and straw.

The first wave, which was to cut and remove wire entanglements, started for their point of departure, between 1000 and 1100 yards from the German line, as soon as darkness set in. The second wave, which was to attack, followed about an hour later. The motor exhausts were provided with mufflers, while mine and artillery fire assisted in deadening the noise made by the clattering tracks. The fog and rain of the past few days were of inestimable value in concealing the advance, and German fliers failed to detect the approach of troops destined to make the attack.

The principal objectives of the tanks were the Hindenburg line and its supporting (Siegfried) line, including Ribécourt and the trenches between these points, which were to be taken in three waves. The attack was then to press forward to Masnières, Bois des Neuf, Premy Chaple, Fontaine-Notre Dame, and the village and forest of Bourlon, as well as the bridgehead at Crèvecoeur and the town of Rumilly. Contrary to usual practice, artillery preparation of several days duration was omitted.

AT 6:20 on the morning of November 20, 1917, the first tank wave was on the way to cut and remove the wire. The tanks assigned to the original attacking divisions were—1st Tank Brigade: battalion C to the 62nd Infantry Division, battalions D and E to the 21st Infantry Division; 2nd Tank Brigade: battalions H and B to the 6th Infantry Division; 3rd Tank Brigade: battalions A and J to the 20th Infantry Division, battalions F and G to the 12th Infantry Division.

These five divisions (Map I), with two divisions in reserve, were concentrated on a front of six miles between the legs of the triangle—Peronne-Cambrai-Bapaume. Counterbattery fire and a rolling barrage were started with the advance of the first wave by some 300 pieces of heavy and 700 pieces of light artillery. Gas and smoke demonstrations, as well as artillery fire, followed along the rest of the British line.

The second tank wave was to wipe out as many machine-gun nests and infantry strong points as possible; it was also to support the infantry as long as necessary, after which the tanks were to be relieved, reformed, and given fresh orders. Several tanks were employed in maintaining communication with the rear.

The advancing artillery, however, could not use the roads cut by the tanks until the cut wire entanglements had been removed by special tanks equipped with grapnels. The advancing tanks dropped their fascines in the trenches as they approached them, while the artillery carried additional fascines for filling where the tanks had failed to complete the roads for crossing. Specially cleared roads were assigned to the cavalry. The second wave was formed of battle tanks, alternately male and female, about fifty yards apart.

It may be remarked here that secondary attacks made at Vendhuille, Bulecourt, and Inchy were without results. The 56th Division, accompanied by dummy tanks to create the impression of a mass tank attack, was launched against Inchy, but accomplished very little.

The main attack was, of course, against the Hindenburg and Siegfried lines, and then on to Fontaine-Notre Dame and Bourlon—which places were ordered to be taken on the first day. Under the leadership of eighteen tanks from C battalion, whose point of departure was southeast of Gonnelieu, the 36th Brigade of the 12th Division advanced to the northeast and captured the first objective. F battalion was in position on the left flank of the 12th Division. The 35th Brigade leapfrogged the 36th and, with the assistance of the tanks, captured the second objective. Finally the 37th Brigade leapfrogged the 35th and 36th, wheeled to the right, and occupied the west bank of the Shelde Canal between Banteux and Crèvecoeur. Captured tank crews informed the Germans that the right wing at Banteux had been held up by heavy machine-gun fire and had reached only the first objective. The other objectives were taken after but slight resistance.

An examination of the field later showed that C battalion had suffered severe losses. Eight derelict tanks were found halfway between Gonnelieu and Banteux. These were tanks C-36, C-3, C-5, C-23, C-21, C-14, C-52 and S-18. Tanks C-51

and C-59-W were found north of the Gouzeaucourt-Le Pavé road. F battalion also was sent into this sector, since of this battalion five additional tanks were found derelict.

The 60th and 61st Brigades of the 20th Division proceeded to the front, followed by the 59th. After the first and second objectives had been taken by the 60th and 61st Brigades, the 59th leapfrogged them, wheeled to the right, advanced across the canal, and dug in on the heights opposite Crevècoeur. The attack made by the 59th on Crevècoeur was repulsed by heavy machine-gun and rifle fire. J battalion on the right wing and A battalion on the left took part in the attack, and of these, German observers counted fifteen derelict tanks between La Vacquerie and the railway embankment at Villers Guislain-Plouich-Marcoing, while the J-6 was "dead" within the German lines.

The task assigned to J battalion, in coöperation with a special detail of the Third Corps, was to attempt a surprise break-through between the L'Escaut Canal and the Canal du Nord west of Havrincourt. This battalion was assigned to the 59th and 61st Brigades, and was to open the attack while being covered by a barrage and smoke-bomb fire. The barrage was laid on the German front and was advanced ahead of the attackers. The 20th Division, with the 61st Brigade on the right and the 60th on the left wings, followed the tanks, the 59th being held in reserve. The 61st attacked in three waves preceded by eighteen, twelve and six tanks respectively. The tanks in the first wave consisted of twelve of the 27th company and six of the 26th company of J battalion, with orders to take the trenches at La Vacquerie and northwest of the latter so far as these trenches lay within the brigade zone. No tank of this wave was to proceed beyond La Vacquerie before the accompanying infantry had established itself in the town. A few of the tanks were ordered to proceed ahead of the wave until the former were within 200 yards of the enemy line. The tank wave was then to proceed toward designated points from where they were to press on toward the positions assigned them.

NINE tanks of the 27th company in the first wave were assigned the task of taking La Vacquerie, and after the infantry had established itself in the captured town the tanks were to proceed against and take the second objective. The second-wave tanks, after the capture of La Vacquerie, were to follow over the crossings established by the first wave and leapfrog the latter. The third wave of six tanks had as its objective the capture of the last line of trenches and was to be assisted by the first wave which in the meantime would be relieved at La Vacquerie.

Each succeeding wave was to mop up machine-gun nests and infantry strong points which had been passed over by the preceding wave, and then proceed to its new objective. Communication between tanks was established through visual signals and runners, while that between tank and brigade staffs was by carrier pigeons. Wireless also was employed.

The tank support of the 60th Brigade, with the accompanying infantry, was to proceed to within 1000 yards of the first enemy line during the night preceding the attack. The 26th company was to attack in two waves—group 7 to the left and group 8 to the right forming the first wave, and group 5 on the left and group 6 on the right, the second wave. After a successful attack, and after the infantry had reported itself established in the captured position, the tanks were to proceed, without further delay, to the battalion rendezvous.

The 29th Division followed the 20th and entered the line to the left of the latter. A battalion, less one company, was assigned to the 29th. The left wing of this division occupied Noyelles, while the right crossed the canal between Marcoing and Masnières. Tank F-22 at noon attempted to cross the incompletely demolished bridge at Masnières, but broke through and carried a portion of the bridge with it. Only a few "dead" or derelict tanks were located in this sector. The tanks which had advanced from Marcoing on Rumilly failed to reach their objective and turned back.

The 6th Division, with the 16th Brigade on the right and the 71st on the left wing, was assigned to a break-through against Ribécourt and the heights to its east, the break-through to be effected between Villers Plouich and Beaucamp. B tank battalion was assigned to the 16th Brigade and H battalion to the 71st. A tank march chart, found in a derelict of B battalion, gave the starting point for this battalion half northerly of Villers Plouich, while that of H battalion was at Beaucamp.

Ten minutes before the opening of artillery fire on the morning of the 20th the tanks were on the way. The distance between the tanks and the barrage line was about 1475 yards. Seventy-two tanks of the 2nd Brigade entered the action; four tanks of H battalion suffered breakdowns but were replaced by four from the reserves.

Forty tanks were assigned for the attack on the trenches in conformity with the plan developed during the days of training in the rear area. Brig. Gen. Hugh Elles, commanding the tank corps, led the attack in the right guide tank of H battalion, his tank carrying the tank-corps flag. The infantry followed closely behind the tanks. German resistance was weak, and the tanks were soon relieved by the infantry.

The second tank wave was assigned the task of mopping up Ribécourt, the intermediate points of Couillet Forest, and the communicating trenches between the first line and its support. The attack on the Hindenburg position was to be completed by 8:20 A.M. and that against the support position was to begin thirty minutes later. Everything proceeded according to program. The infantry, which followed closely behind the tanks, soon took over, and Ribécourt with the country surrounding Couillet Forest was cleaned up with little resistance.

The Hindenburg support position was attacked by twenty-four tanks which began the forward movement thirty minutes after the departure of the first wave. Two companies of the first wave, which by this time had been reassembled and were intended for the fourth battle sector, supported the attack. All available tanks from the first sector were also to enter the action. Of the seventy-two tanks which had entered the battle, sixty-three passed over the support line, some ahead and some behind the infantry. Resistance here also was weak, and the position was completely mopped up by the infantry at 11 A.M.

One company of B battalion and one of H battalion had the mission of going forward, without infantry support, immediately after the support line had been captured, with orders to take the bridges at Marcoing. Battalion B was to take Marcoing and the bridges, while H was to take Bois des Neuf and Premy Farm and then to establish communication with E battalion of the 1st Brigade, which had attacked Flesquières. All tanks arrived before Marcoing at about 11:30 A.M. and encountered severe resistance at several points; they, however, entered the town and the uninjured bridges fell into British hands. (*To be concluded in the next issue.*)

Pressure Measurement

A New Carbon-Element Device Applicable to Ordnance

By A. W. Krause*

THE measurement of fluid pressure in a containing vessel is one of the oldest technical problems. The mercury manometer and the usual mechanical indicators are impressive monuments in the history of pressure-measuring apparatus, extending back over a period of approximately 250 years. With the advent of large power plants, centralized pressure control grew in importance and stimulated the development of electric pressure-measuring devices.

Two fundamental cases are of importance here. One may wish either to record all the slowly changing pressures which may occur at different places in a power plant or to record very rapidly changing pressures, such as occur in gas engines. The first case generally calls for teleindication of slowly varying pressures; the second case is met in the power measurement of high-speed machines.

The construction of teleindicators can be varied, but in most cases hitherto the mechanical principle has been retained, as in tube manometers. The mechanical motion of the pressure element controls an electric circuit, and the distant record employs the well-known ink-and-pen method of the astronomical chronographs.

Far more interesting is the second case in which an electrical system is employed to measure rapidly changing pressures. These pressure variations are of such short duration that mechanical pressure indicators are of no value at all.

The principle of the Berliner telephone transmitter suggests to us ways and means of following these rapidly changing pressure cycles. It remains only to find a method of recording these changes. The string oscillograph and the cathode-ray oscillograph are helpful means of recording these fast-changing cycles and are available for electrical pressure measurements. Within the last few years a great number of electric pressure-measuring devices have been produced, applying well-known electrical quantities in their measuring processes: voltage (piezo-crystal), capacity (condenser method), induction (electromagnetic method), permeability (magneto-elastic method), and resistance (carbon method).

All these methods require, in application, a more or less high-frequency current which serves as a carrier for the current to be recorded, and a sensitive voltage amplifier, as in the piezo-crystal method. The auxiliary apparatus between the pressure under test and the recorder (oscillograph) is very complex and expensive. The complexity of so many instruments also reduces the safety factor. Simplicity, reliability, and number of instruments are considerations which practically determine the method of recording pressures. All these previously mentioned methods are faulty in one or another requirement, except the pure resistance method. Fortunately, external electrical disturbances have no effect upon the carbon method which we are about to describe; the instrument is simple, rugged, and requires no auxiliary apparatus. In cases where slowly changing pressures are to be recorded, a pressure element and milliammeter calibrated in kilograms per square centimeter is sufficient; if rapidly changing pressures are to be recorded, an oscillograph may be employed with advantage.

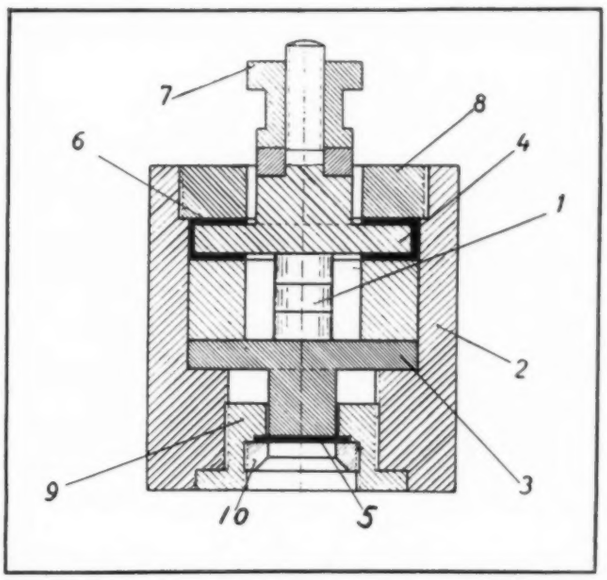


FIG. 1. MECHANICAL CONSTRUCTION OF NEW CARBON ELEMENT

SINCE Berliner's application of the carbon-button microphone, the characteristics of certain electric semiconductors, such as artificial carbon and powder, have been studied. These semiconductors vary their ohmic resistance in proportion to mechanical pressure. Applying these characteristics of semiconductors, a few electric pressure meters have been developed in the last thirty years, notably by Peters, a frequency meter by Siemann, and others. The systems are of remarkable simplicity but have some inherent traits, such as sluggishness, which prevented their use in recording small variations of pressure. The main obstacles to the use of these instruments are the drift of the zero point and a large hysteresis error. Exact measurements with them are impossible. The development of a new carbon element here described has overcome all these shortcomings, so that an accurate, simple device is now available.

The mechanical construction of the new carbon element is shown in Fig. 1. The pressure element is simply a purely ohmic resistance, represented by the carbon disc (1). As soon as the pressure load is applied, the electric resistance of the carbon disc is reduced. The discs are held under a certain standard pressure by the steel diaphragms (3) and (4). The external housing of the element can be constructed according to requirements. Examples of these will be explained below.

The carbon pressure element is used in a 2-volt D. C. circuit. The total resistance of the carbon discs under fixed

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standard pressure is 5 ohms; therefore a current of 400 milliamperes flows in the circuit under these standard conditions, neglecting wire resistance. The current travels through the housing, carbon discs, and leaves the pressure element by way of a screw (7) which is insulated from the rest of the housing.

A load applied on the pressure element deflects the steel diaphragm (3) and compresses the carbon discs. A diaphragm (5) in front of the main diaphragm (3) protects the movement from mechanical injuries and is also demanded by structural reasons. The protective diaphragm (5) is held in place by two circular nuts (9) and (10). The upper diaphragm (4) is insulated from the rest of the housing (2). A well-fitted ring (8) is pressed on top of the insulated diaphragm (4), and a second ring (11) keeps the pressure normal to the carbon discs (1). Drawing from experience with the ordinary carbon-button microphone, one may say that the compression of the carbon for a certain deflection on a milliammeter is well known. These displacements of the diaphragm are very small and are in the vicinity of a few thousandths of a millimeter. To reproduce this condition in the electric pressure meter and also to enable it to follow very rapid pressure changes the diaphragm should be small. The resonance frequency of the mechanical system, consisting of the diaphragm with the included carbon discs, has to be high, of the order of 60,000 to 80,000 cycles. That high resonating frequency of the element is very important when one wishes to reproduce a true picture of the pressure under test. Rapid changes of pressure call for great stiffness. The frequency and amplitude of this system must correctly represent the external frequency and amplitude which are being measured.

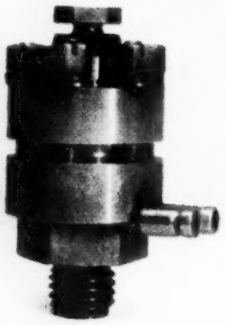

FIG. 2. CARBON-PIEZO METER FOR DIESEL ENGINE PRESSURES

The upper pressure-measuring limit of the carbon-piezo meter is set by the material strength of the ring and diaphragms. The lower limit, at present, is the atmospheric pressure. Experiments are now under way to use the piezo meter for measuring pressures lower than atmospheric. Constant or slightly varying pressure differences are measurable if a hydraulic or mechanical pressure reduction can be applied. The most successful application of the electric carbon-piezo meter at present is at pressures higher than atmospheric.

THE carbon pressure element is used in a simple circuit made up of two loops having one side in common. The balance resistor is variable and is best placed on the switchboard, which also carries the indicating apparatus (milliammeter or oscillograph). The variable resistor is used to balance the pressure element as well as the resistance of the line between power supply and pressure recorder. In permanent installations, the resistor is adjusted so that the differential current is zero when the external pressure is zero, thereafter no further attention is needed. This compensating resistor should be of low capacity and noninductive. If slow pressure changes are to be observed, a milliammeter calibrated in kilograms per square centimeter will suffice; if rapidly varying pressures are to be recorded, an oscillograph is better suited. The power supply is a battery of sufficient capacity. It is very important to have the two cells large enough to prevent a voltage drop when the differential current is increased. Automobile batteries of 100-ampere-hour capacity serve the purpose very well. If the installation is permanent, a battery charger should of course be provided in order to keep the voltage constant.

If the resistance is so adjusted that no current flows in the common arm, and the carbon pressure element is connected to suit the special case, then any current change will be in proportion to the pressure applied. The calibration of the pressure element is affected very slightly by moderate overload, but for heavy overloading the resistance of the carbon element makes a gradual approach to a constant value. A very valuable asset of the carbon element is its immunity to overload up to a limit of double value—about one hundred per cent. If, however, higher pressures than those rated are applied, the instrument is not destroyed; the sensitivity only is changed. By consulting the calibration chart it is possible to determine these higher pressures.

THE carbon pressure meter is very little affected by temperature. Temperature differences of fifty degrees C. have no effect on the pressure indication. If the indicator diagram of an internal-combustion engine is to be taken, the pressure element can be jacketed by a stream of water and kept at a fixed temperature. If this simple method is not available, a calibration at the temperature under investigation will solve the problem of obtaining a correct indication.

Static, constant, or very slowly changing pressures are well enough indicated by a milliammeter. The milliammeter should have a scale calibrated in kilograms per square centimeter; this makes direct reading of the instrument simple. If, however, the quickly changing pressures in the chamber of a combustion engine are under consideration, then a suitable oscillograph has to be chosen for indication.

The carbon pressure elements are designed for thirty ma., when the maximum rated pressure is applied. This can of course be changed, depending largely on the sensitivity of the recording mechanism. The sensitivity of the system should be chosen so as to give at least a 15-cm. deflection when the maximum current is applied. In order to use the carbon pressure element effectively, the optical system should be so fast as to record amplitudes as small as one-half millimeter. If this is observed, the error is between two and three per cent, by increasing or decreasing the pressures. This error is well within the limits of an ordinary indicator diagram.

Cathode-ray or string oscillographs may be used to indicate or record the pressure. As the cathode-ray oscillograph correctly indicates voltages only, the string oscillograph, which indicates currents, seems the better indicator. The cathode-ray tube no doubt is superior, as the system is inertialess, but unfortunately requires a voltage amplifier between the carbon element and indicator. This amplifier has to be specially designed—push-pull for the entire system. This can be done, but it increases cost and adds to the complexity of the installation. A few cases may exist where a cathode-ray oscillograph is the only means of recording the pressure

changes. The ordinary string oscillograph is adequate in recording all every-day pressure phenomena. If the power output of any combustion engine needs improvement, the string oscillograph will point out the source of the deficiency.

This instrument is suitable particularly for investigation of oil pressure and combustion diagrams of Diesel engines. The pressure changes may be photographed or observed visually. These oscillographs can be constructed so as to be portable or stationary. With the aid of such equipment it is easy to notice any slow leakages of piston rings or valves and to obtain exact measurements. This is quite important, as it will prevent complete breakdown of the machine and also indicate the efficiency of each cyinder. By the application of such instruments, especially in large power plants, many repairs on cylinders and valves will be avoided.

TO CALIBRATE the carbon pressure meter (Fig. 2), it was necessary to develop an instrument for the purpose. When calibrating a unit, the pressure element as well as the lead wires are included in the bridge circuit. A milliammeter or oscillograph calibrated in kilograms per square centimeter serves as the indicator. This is the same apparatus as is used in actual practice. In the calibration apparatus necessary to make a calibration chart of a carbon pressure element for employment on Diesel engines, the carbon pressure element is held in place by a thread, at a convenient place by a hydraulic press, and oil pressure is applied in the conventional way. The oil pressure is indicated on a highly accurate manometer, and the deflection of the milliammeter or oscillograph is recorded. The calibration chart is thus obtained.

The carbon-piezo element also can be calibrated dynamically. To calibrate the element in this manner, pressure is applied by means of a rotating valve from a known pressure source, but this pressure is varying from a minimum to a constant known maximum. In this manner the pressure element is exposed to short, shock-like pressures which correspond to the pressure under test in practical application. To simulate the exact working condition, a certain number of known pressures should be applied, the pressure element is exposed to them and the pressure is changed suddenly, first slowly, then faster, and then again decreasing in speed. Thus a perfect calibration chart is obtained. These varying pressures on the pressure element produce a current diagram on the oscillograph. A perfect pressure element should reproduce faithfully all varying pressures, whether the pressure is increasing or decreasing.

To calibrate the pressure element dynamically necessitates an elaborate test machine, but this is not absolutely necessary. Very satisfactory results can be obtained by using a static pressure machine. If the static diagram shows no marked hysteresis then a dynamic calibration will not improve the test very much. To get an absolutely faithful record of the pressure element, a dynamical pressure calibration is of course better. This is particularly true if very slight changes have to be detected. Dynamic pressure test apparatus can be built for almost any desired pressure.

AS THE field of application of the carbon pressure element is very large, it is almost impossible to predict with any degree of certainty its usefulness in the art of pressure measurement. Due to its simple construction, ruggedness, and ease of operation, the element can be applied to any pressure phenomenon as long as it is possible to calibrate the instrument with artificial pressures.

Pressures in the oceans are known, or may be computed approximately, but actual measurement of the pressures at different depths would be appreciated greatly by many scientists. By dropping a carbon element to different depths a complete record at different places in the ocean could be obtained. As the pressures are static, a simple pressure element with milliammeter serving as the indicator would serve the purpose.

The pressures which are generated in a gun barrel are not too well known, and if accurate data could be obtained, very valuable information would be at hand for the manufacturer of powder as well as for the maker of the gun. A graphic record could be obtained by inserting a pressure element into the barrel and observing time and amplitude of the pressure process. As the element is very simple and rugged it could be attached permanently, since no damage is done even when overloaded.

To take an indicator diagram on a Diesel engine, it is necessary to cool the pressure element. This is best done by a water line. Pressure elements are placed in the oil chamber, priming chamber, and explosion chamber, and all three records photographed or observed on an oscillograph. This will indicate very exactly the cause of diminished efficiency in the case of any leaky pistons or valves. By installing carbon pressure elements at different points in a steam or hydro plant, all pressures can be observed at a centralized switchboard, as distances can be readily balanced by the bridge circuit into which the pressure element is placed. At present, many machines need mechanical pressure indicators which can be inserted at the respective machines and read at long distances.

A knowledge of exact pressures and stresses exerted by tools on the material to be worked is of great importance as an exact working condition thus can be obtained. For this purpose the pressure element can be placed in the tool holder and the pressures recorded during the working process. The electric pressure element can be used also as a dynamometer. It also can be mounted on the axle of a moving vehicle and pressures and sudden changes observed at any speed and under any road condition. Other applications of this electric pressure element will occur readily to engineers.

ARMY ORDNANCE

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Month by Month

THE greater portion of this issue of Army Ordnance is given over to the proceedings of the Association's Eighteenth Annual Meeting. The principal addresses are published verbatim in the articles by the several speakers; the proceedings in Washington and at the Aberdeen Proving Ground, May 12 and 13, 1937, appear in the "Association Affairs" department.

The Annual Meeting

Through the courtesy of the National Broadcasting Company the addresses of Colonel Payne, General Harbord and Mr. Belloc were broadcast over the coast-to-coast Blue Network. Hence many members who were not present in person may have listened in.

There are two comments on the meeting which we feel should be made a part of the record. The first refers to the nature of the addresses. To have presented analyses such as those of General Harbord, General Crozier, General Tschappat and Mr. Belloc in the interest of a correct understanding of industrial mobilization is noteworthy in the annals of industrial preparedness. A distinguished company was present and the larger audience throughout the land had an opportunity seldom afforded them. The second comment refers to the type of program presented during the engineering conference at the Aberdeen Proving Ground. This was a departure from past Ordnance Days. It was not a three-ring circus but a technical demonstration of the highest importance. The attendance was small and those present were the engineers and leaders of American industry upon whom the success of the Ordnance cause depends.

To all members of the Association who took part in the several sessions and to all those who, unable to attend, manifested that friendly interest which always has marked the life and growth of our organization, thanks are extended. In particular, to Maj. Gen. William H. Tschappat, Chief of Ordnance and the officers of his staff and to Col. Charles M. Wesson, Commanding Officer of the Aberdeen Proving Ground, his military and civilian personnel who assisted in the program, go the grateful feelings of all who were in attendance.

AT the request of several members we publish below the roster of Army Ordnance Medalists.

Army Ordnance Medalists

The Williams Medal for Distinguished Ordnance Service was founded in 1930 in honor of Maj. Gen. C. C. Williams, Chief of Ordnance, 1918-1930. The only award of this medal was made to General Williams, October 8, 1930, as "the leading exponent of the education of industry to the needs of the national defense."

The Ordnance Medal of Merit was founded in 1931. This medal has been awarded as follows: In 1931 to Col. Robert P. Lamont, for leadership and administrative ability in the progress of munitions preparedness; to Maj. Gen. William Crozier, for achievement in the invention, design, development and manufacture of military armament; to Col. William C. Spruance, for outstanding service in the advancement of industrial preparedness; to Brig. Gen. Guy E. Tripp, (posthumous) founder of the Ordnance system of decentralized procurement; and to Maj. Wm. P. Wilson (posthumous) for the design and development of the Wilson antiaircraft director.

In 1932 the Medal of Merit was awarded to Col. Frank A. Scott, for leadership and administrative ability in the progress of munitions preparedness; to Brig. Gen. John H. Rice, for design, development and production of military armament; to Brig. Gen. C. L'H. Ruggles, for outstanding service in the advancement of industrial preparedness.

In 1935 awards were made to Hon. Newton D. Baker, for distinguished leadership in the successful effort of the United States in the World War; to Bernard M. Baruch for leadership in mobilizing the nation's industrial power for the production of armament during the World War; to Col. Rogers Birnie for engineering skill in the development of gun making in the United States.

The twelfth recipient of this award is Maj. Gen. James G. Harbord for leadership in administering the Services of Supply, American Expeditionary Forces, and for administrative ability in peace and war.

COINCIDENT with the recent annual meeting of the Association the chiefs and assistant chiefs of the Ordnance Procurement Districts assembled in Washington on May 12th for their annual conference with the Chief of Ordnance. Some of them have been towers of strength in industrial preparedness for many years. Others have only recently accepted official service in the district organization. All are acknowledged leaders in private industry who are giving most valued and patriotic service. Their annual conference enables these operating heads of the decentralized procurement organization to review with the officers of the centralized control staff all the problems, progress and projected activity of peacetime procurement planning.

Ordnance Leaders

Many of these gentlemen are closely identified with the Army Ordnance Association. The dual service is a happy omen which continues to advance the Ordnance cause.

officially and unofficially. In both enterprises their leadership is of untold importance to our national defense.

TOY DISARMAMENT!

THIS time, from a conference on "education for peace" held in the Ethical Culture School in New York, comes another of those proposals for toy disarmament. One of the speakers is reported to have urged that an attempt should be made "to convince toy manufacturers that there is a market for lead postmen and hodcarriers and other workers of society, instead of toy soldiers."

Shades of childhood! What lead postman, with his incessant ringing of make-believe front door bells, could hold forth very long on the living room carpet against the childish glee a flank attack furnishes! We imagine that, if the toy manufacturers ever follow the suggestion, young America will provide itself with Tommy guns in the form of broom handles and the attack will be staged anyway. We hope the day will never come when our boys will follow the ideas of some of their elders who, failing in their nonsense about real disarmament, now turn to toys.

And what lead hodcarrier can hold his place against a company of Marines on one side of the easy chair while an enemy brigade is outflanked near the right front piano leg? Without those two wind-up tanks the action will fail. An airplane or two may save the day—that is if the ground guns under the table are not discovered and the ammunition holds out! Who said the hodcarrier will be of any earthly use as a hodcarrier in such a brave fight to a finish? Maybe he's a pretty good hodcarrier but he'll have to throw the hod away and man a gun.

If the toy manufacturers ever are controlled by a Lead Soldier and Toy Gun Control Board and none of them is licensed because this living room carpet has been decreed a civil war zone—well, what of it? Dad's fountain pen or Mother's crochet needle will do in a pinch and the lead hodcarrier manned with either of these trusty weapons can do his part just as heroically. (In the face of such failure to control, the only thing left will be to license boyhood itself!)

Carry the thing a step further. Instead of military training for our high school cadets and the manual of arms for the R.O.T.C., why not a company of postmen figuratively pushing mythical front door bells in the high school yard and a squad or two of R.O.T.C.'s carrying hods on the college campus. Some of the students might profit by the discipline and thus prepare themselves for later life. Military training in the schools must be the last course to go—there are hundreds of frills to be taken out of education but military training and discipline are not among them.

President Roosevelt in a splendidly patriotic speech to the cadets of the Texas Agricultural and Mechanical College recently expressed the sound basic attitude toward false pacifism and adequate preparedness. "Some people think of military training in terms of acute pacifism," he said. "You and I do not. We think in terms of the preservation of the nation. Our preparation is honestly made for defense, not for aggression." Ethical culture groups and teachers' guilds should take the President's words to heart. Young America will do so at any rate, and the position behind the sofa will be defended as long as toy soldiers and living room carpets and playroom floors and above all, boys, are what they are!

PROTECTIVE MOBILIZATION PLAN

THE Committee on Appropriations of the House of Representatives in its report on the military establishment recommending appropriations for the next fiscal year, made the following pertinent observation:

"There is a ray of hope in the plan recently adopted by the War Department looking to the establishment of a definite and reasonable objective as to the more important elements of matériel needs for current use and as an emergency reserve. There is not and has not been for many years any balance as between war reserves and man power at the beginning of an emergency and during the period required for production, Government and private, to supply deficiencies and subsequent demands. The aim heretofore has been to have at some time a reserve of essential items to meet the requirements in active operations of two field armies, or 1,000,000 men, 'to bridge the gap between the beginning of an emergency and the time production can supply the needed requirements.' Under the new plan that number of men has been substantially reduced and reserve needs are being restudied to bring personnel and matériel into harmony. Procurement planning has a part in the picture, as it has heretofore, but possibly in a more intensive way.

"The new plan obviously will result in a very considerable reduction of war reserve requirements. It is the purpose of the committee to insist, so far as practicable, upon a crystallization of the plan before consideration of the next appropriation bill begins in order that it may be used as a guide in recommending appropriations in the future. As to essential elements considered necessary to be on hand on M-day, there should be accessible to the committee, as the agent of the House, schedules showing requirements, quantities on hand, and an estimate of the cost to supply deficiencies."

This is significant and a step in the right direction.

ANTIAIRCRAFT IN SPAIN

WHAT a farce the American press is making of the news from Spain! The treatment of the horror stories and pictures is an insult to average intelligence: the only bombs that ever hit a woman or child are dropped by General Franco's forces; one picture of a damaged apartment building in Madrid was repeated over and over again as though it were a new occurrence each day. And further to influence public opinion many of our "neutrality" experts, some of whom are responsible for our present scuttle-and-run law, have promptly aligned themselves with a committee to aid "Spanish democracy"!

Not so uncertain, however, are authentic reports on the battle performance of antiaircraft and tanks. Reliable news sources say that antiaircraft fire has become a dangerous adversary to every type of aircraft in flight. It is said that the World War ratio of effectiveness of antiaircraft artillery of 5 to 1 (five airplanes brought down by enemy pursuit craft as against one by artillery fire) seems to be definitely reversed in favor of the artillery.

The same sources report that the light, fast tank is a disillusionment. The vehicles used are said to be easy prey to antitank guns and to machine guns and even to steady infantry fire. Heavier armor and less speed are demanded. When propaganda ceases in the news from Spain there will be many vital lessons for the student of modern armament.

On Educational Orders

An Editorial

EDUCATIONAL orders for military armament are peacetime trial undertakings, at the direction of the Secretary of War, by responsible private producers for the manufacture of noncommercial ordnance matériel in limited quantities from time to time. The sole purpose of such orders is to familiarize the producer with the design, required production technique, factory plan, and equipment for the more effective manufacture of such matériel by private industry in time of war.

As far as the record shows, educational orders for the peacetime production of noncommercial items of ordnance were first proposed in 1922. That was seventeen years ago—and still there are no educational orders as such. The convincing article, "Procurement Planning" by Lieut. Col. G. M. Barnes in this issue of ARMY ORDNANCE recalls this important subject in a new light. It suggests the sound theory upon which industrial preparedness, our new philosophy of national defense, rests. It shows the marked distinction between American and European systems of military security and why the distinction exists. Moreover, it stresses the one element which may be the choke point in any war-time industrial mobilization. That choke point will come from lack of experience on the part of private industry in the production of ordnance. Lack of such experience will lengthen the time between the start of mobilization and the beginning of effective production. Thus, emphasis remains where it was put seventeen years ago—upon educational orders. It is appropriate that we review the unsuccessful history of this essential part of our American system of national defense. The subject is horribly misunderstood; but it is none the less important.

Immediately industrial mobilization planning became a major tenet of our defense philosophy when the National Defense Act of 1920 was adopted, it became apparent that a knowledge of the *size* of our military requirements in time of war is basic. We had not had that approach before. Likewise, a knowledge of the *kinds* of requirements from the standpoint of design and specifications and production engineering is basic. We had not had that concept before. We now have both theories in operation; some details are complete, some are incomplete. Production engineering as applied to design, for instance, is still a subject for more exact development but progress in this field is being made. These functions—all of them—are responsibilities of government. Industry's responsibility is in the "know how"—the ability to produce in quantity in time of war. Educational orders in time of peace are the one and only way by which industry can guarantee to meet that responsibility.

IN 1926, the late Guy E. Tripp, then a vice-president of the Army Ordnance Association, as head of the Committee on Industrial Preparedness took the first comprehensive step toward educational orders. Prior to that the idea had been explained and recommended by Maj. Gen. C. C. Williams, renowned Chief of Ordnance. The late Brig. Gen. C. L'H. Ruggles, then Assistant Chief of Ordnance, had expounded the principle from the speaker's rostrum throughout the country. Four years before the Tripp Board recommendations, in 1922, the Secretary of War, Mr. Weeks, had suggested educational orders as an essential part of the solution of the ordnance problem. He proposed "to give annually to a few private plants educational orders for small amounts of selected types of munitions which would serve the retention by such plants of a small nucleus of men capable of producing these types." The objective was to distribute educational orders to as many different nonordnance-producing commercial plants as conditions might permit. But the Tripp Board directed attention to educational orders as it had not been directed before and has not been since. General Tripp held:

"Practically all the knowledge needed to organize and employ an expanded army is automatically maintained by the peace-time activities of the country with the all-important exceptions that (a) knowledge of the *use* of arms, and (b) knowledge of the *manufacture* of arms, must be stimulated in time of peace in order to be available adequately and promptly in event of emergency. In order to be able to attain mass production as soon as possible in the critical first months of a possible emergency, it is absolutely necessary that the manufacturer, in time of peace, should have an opportunity to run through his plant a small order, only sufficient in size to work out the 'bugs' in the paper plans prepared by the manufacturer in coöperation with Army officers. All the manufacturer asks is that he be reimbursed for his out-of-pocket expenditures. . . . What America needs most at present is a greater knowledge of ordnance manufacture, and all artificial obstacles to the acquirement of this knowledge by American industry should be removed forthwith and every effort made through legislative enactment to stimulate the acquisition of this vital knowledge."

The proposed legislative enactment was submitted to Congress shortly thereafter by the then Secretary of War, Mr. Davis.

At this point it should be made clear that educational orders have never been thought of in terms of profit to the private producer. Mr. Ernest M. Trigg, then chairman of the Committee on National Defense of the U. S. Chamber of Commerce, in an address before the Twelfth Annual Meeting of the Army Ordnance Association, October 8, 1930, stated this phase of the project in the following words:

"It is hardly necessary for me to add that educational orders are not designed to be, nor will they be, a profitable source for new business to American industry. The representative manufacturers who appeared before the House Committee on Military Affairs and the Chamber of Commerce of the United States are not in the slightest interested in such orders as a source of new business or of profit. We are interested in them solely and wholly from the viewpoint of national defense."

FIRST consideration of educational orders by Congress was in 1927, when Hon. Edith Norse Rogers introduced a measure (H. R. 14695) modifying Section 5a of the National Defense Act, which would permit the Assistant Secretary of War to place such educational orders as he deemed desirable with commercial firms. The measure was actively supported by then Secretary Davis and by a former Assistant Secretary of War, then Congressman J. M. Wainwright and by General Ruggles. The measure failed of enactment but was reintro-

duced in 1929 at the request of the Secretary of War. After extensive hearings, where the bill received the active support of the War Department, it was reported favorably by the Committee on Military Affairs with extensive amendments. As amended, the bill provided that educational orders might be placed for technical noncommercial articles, but required prior advertisement for bids, the Secretary being authorized to select other than the lowest bid. It required the number of such educational orders to be held to a minimum in the interest of economy, permitting only one order to be given a firm in a period of three years. It required that the plant and its processes be open to inspection by any person designated by the Secretary of War during execution of the educational order. It provided that the preparation of factory plans be included in the order when directed by the Secretary of War. It authorized the expenditure of not more than $1,000,000 in each of the next five fiscal years out of funds appropriated to carry out the provisions of the bill. The measure was reported favorably by the Committee on Military Affairs but was never enacted.

In March 1933, Senator Hiram Bingham and Congressman Edward H. Goss again brought the matter to the fore in identical bills (S. 1660; H. R. 123). In structure the Goss bill resembled the earlier proposal but differed from it in two important aspects: It did not seek to amend the National Defense Act, and it authorized an expenditure of $2,000,000 annually for five years—one-half to be spent in Government arsenals, the other half among private manufacturers who were not to be selected on the basis of low bid. This measure died with the Congress.

Then came the well-grounded plea that educational orders be adopted as a priming agency in industrial recovery. Lieut. Col. LeRoy Hodges, a director of the Army Ordnance Association, contributed to these pages a sound plea that a small part of the vast sums appropriated for public works be allotted to this purpose. His discussion attracted nation-wide attention. Professional publications, like *American Machinist*, made similar proposals. Very wisely the President earmarked some of the first recovery appropriation for naval rearmament and for military mechanization and modernization. Indeed one of the purposes of the Industrial Recovery Act, later administered by the Public Works Administration, was explicitly for that purpose. But the second recovery appropriation contained a proviso that "munitions" could not be included in the purposes for which the money could be spent. There could be elephant houses and dog pounds and theater projects but nothing like educational orders. Some people held that "military expenditures are not socially beneficial." Elephant houses and dog pounds and theater projects apparently were! "Munitions makers" were said to be a cause of war and the country fell for such nonsense while political spellbinders raked in the shekels. And in those out-of-joint days, educational orders were as dead an issue as Abolition or "Tippecanoe and Tyler too."

AGAIN, as recently as April 8, 1937, Congressman Smith, of Connecticut, introduced an educational-orders bill (H. R. 6246) in the present Congress. Mr. Smith's proposal in its entirety is as follows:

"A bill to provide for placing educational orders to familiarize private manufacturing establishments with the production of munitions of war of special or technical design, noncommercial in character." (This is the formal title of the bill.)

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized to place educational orders for munitions of war of special or technical design, or both, noncommercial in character (hereinafter called 'special munitions'), and essential accessories and parts thereof needed in the military service, with commercial concerns to familiarize commercial and manufacturing establishments with the manufacture of such munitions and such accessories and parts. In arranging for placing such educational orders, bids shall be solicited only from such establishments as, in the Secretary's judgment, will be competent in time of war to manufacture the particular class of special munitions with respect to which the bid is solicited. In the determination of which classes of special munitions are to be manufactured under this Act, and in the determination of which of the solicited bidders is to be awarded any contract, the Secretary shall have regard solely to the selection of such classes of special munitions and of such bidders as will, in his judgment, under all the circumstances, best serve the interest of the United States and best promote the cause of national defense. The Secretary of War shall enter into no contract under this section without the approval of the President.

"Sec. 2. That the first of any such educational orders placed with any person, firm, or corporation for supplying any such munitions, accessories, or parts, may include a complete set of such gages, dies, jigs, tools, fixtures, and other special aids and appliances, including drawings thereof, as may be required for the production of such munitions, accessories, and parts in quantity in the event of an emergency. The title to all such facilities shall remain in the Government of the United States.

"Sec. 3. That not more than one such educational order for the manufacture of the same, or substantially the same, article of special munitions shall be given to the same person, firm, or corporation within any period of three successive years. This section shall not prohibit the awarding of any contract during any war in which the United States is engaged.

"Sec. 4. That, to carry out the provisions of this Act, there is authorized to be appropriated the sum of $2,000,000 during each of the five fiscal years beginning with the fiscal year during which this Act is enacted."

AND there the matter stands. Whether educational orders will soon become actualities is problematical. In the opinion of many observers the prospect is doubtful because there is too much misunderstanding of the ordnance problem. Too many parlor pinks are bent on nationalization of the arms industry. If nationalization should ever be the law of the land then educational orders must be provided at once and in much larger measure than any proposal has yet contemplated. Preparedness and nationalization are contradictions in terms; preparedness and educational orders are complementary. But private industry must know how to make weapons when weapons have to be made. Knowledge is essential and it will be acquired only in the school of actual experience. That school ranks in importance with any endowed university or land-grant college anywhere. Its graduates would be worthy of the degree "doctor of philosophy in cannon law"! But we have no such college, no such degree and no such alumni. And the national defense of the United States is the worse for not having them—how much worse the adage best describes: "Knowledge without practice makes but half an artist."

Association Affairs

EIGHTEENTH ANNUAL MEETING

LOYALTY to the national defense of the United States and concern for the technical advancement of our military preparedness against war were the dominating notes of the Eighteenth Annual Meeting of the Army Ordnance Association. Several hundred members and guests joined in expressions of these objectives at both sessions of the meeting. The first session was held at the Mayflower Hotel, Washington, D. C., on the evening of Wednesday, May 12th. The second session, an engineering conference, was held the following afternoon, Thursday, May 13th, at the Aberdeen Proving Ground, Md. Both occasions were significant milestones on the road to adequate industrial preparedness.

Maj. Gen. James G. Harbord was awarded the Ordnance Medal of Merit at the Washington session. His address and the other addresses of the meeting are published in this issue of ARMY ORDNANCE. A transcript of the proceedings of the meeting follows:

Brig. Gen. Benedict Crowell, president of the Association presided. In opening the meeting General Crowell said:

"We are particularly pleased to have so many members of the Association, distinguished officers of the Army and Navy of the United States and leaders of American industry assembled here tonight. Your presence is most significant because it should be interpreted, I feel, as an expression of loyalty to our national defense. More than that, it is a sign that industrial preparedness is very much alive.

"For the past eighteen years we of the Army Ordnance Association have assembled to devote our time and thought to the industrial phases of preparedness against war. You will pardon me, I am sure, when I recall that no such function as this was possible twenty years ago. We had no group of American citizens organized as a national body to consider how and where and when the United States might arm itself adequately in time of emergency.

"Immediately following the World War those of us who experienced the lessons which followed in the wake of our lack of preparedness took the preliminary steps to form this organization. For the past eighteen years we have devoted ourselves to one very simple yet vitally necessary objective. That objective is to guarantee to the United States an adequate supply of the military equipment to defend and protect our manhood should we ever again be forced into war. We believe this purpose to be of highest importance and we of the Association take pride in the fact that today industrial preparedness is not forgotten. Yet never before in our history could such a statement be made eighteen years after any major conflict in which we were engaged. I think all of you will agree that the objectives of this organization are of fundamental importance to the welfare and security of our country and I sincerely hope that our numbers will grow, our purposes become better known, and our objectives realized in greater measure during the days to come.

"Our Association is devoted solely and sincerely to the national defense. It has no commercial interests, no political alliances. It is not operated for profit. It strives to the very best of its ability to assist conscientiously and whole-heartedly in the preservation of peace, the limitation of war, but above all the well-being of the United States through an adequate military power of men and the equipment with which they must defend themselves. This is our program and we pledge again, after eighteen years, our devotion and loyalty to it.

"Tonight we are assembled primarily to honor one of America's greatest citizens and to hear addresses which I know will be memorable. We are honored by the presence of the Chief of Ordnance of the Army and no gathering of ours would be complete without a few remarks by him. So before proceeding to the business of the evening I take particular pleasure in presenting to you Maj. Gen. William H. Tschappat, Chief of Ordnance, who will sound the keynote of our gathering, 'Ordnance Principles.' Gentlemen, I present General Tschappat."

FOLLOWING General Tschappat's address (page 17) General Crowell said: "General, we are very grateful for your interesting remarks. We are happy to coöperate with you and the great Department which you are administering so well. May I say to you that we of the Army Ordnance Association exist for no other purpose than to be an auxiliary in private industrial and engineering matters to the official responsibilities which you and the Ordnance Department carry.

"Gentlemen, it is now with great regret that I announce the inability of our honor guest to be with us in person this evening. Until the last moment General Harbord had planned to be here but he is detained in New York by the critical illness of Mrs. Harbord. The seriousness of Mrs. Harbord's illness and his constant presence with her prevented his leaving her bedside for any length of time. And so we admire the General for another of his many examples of constancy and devotion. He has our deepest feelings and our hope for the speedy recovery of Mrs. Harbord. However, at his request, Maj. Gen. Robert C. Davis, formerly The Adjutant General of the Army and the Adjutant General of the American Expeditionary Forces in the World War, will deliver the address General Harbord would have made could he have been here.

"Beginning at 9:15 these proceedings will be broadcast over the coast-to-coast Blue Network of the National Broadcasting Company. Promptly at that moment I will introduce Col. Frederick H. Payne, chairman of our Committee on Award and former Assistant Secretary of War, who will announce the award of our medal to General Harbord. General Davis on behalf of General Harbord will then speak to us from New York. In the General's absence I will ask Colonel Payne to accept the medal and scroll for him to be presented personally at a later time."

COLONEL PAYNE then announced the nomination of General Harbord by the Committee on Award (page 11). The Committee consisted of Colonel Payne, Mr. Edmund A. Russell, of Chicago, president of the Chicago Post of the Association and former Chief of the Chicago Ordnance District, and Mr. Frank B. Bell, of Pittsburgh, Chief of the Pittsburgh Ordnance District. After Colonel Payne's presentation, General Crowell awarded the medal as follows:

"As president of the Army Ordnance Association and conforming with the action of our Committee on Award, I confer upon General Harbord the Ordnance Medal of Merit with the citation as read by Colonel Payne.

"And I wish to add merely the thought that none of the many medals General Harbord wears for heroism on the field of battle and leadership in military and civil life carries with it higher esteem, greater personal admiration, or more sincere commendation."

General Davis then read General Harbord's address (page 9) which was transmitted to Washington where it was heard in the banquet hall as well as by the nation-wide radio audience.

At the conclusion of General Harbord's address the proceedings were again resumed in Washington by General Crowell: "We are extremely grateful for General Harbord's address as delivered by General Davis. What General Harbord has written is an inspiration to us; the principles he espouses are our principles, and we are happy indeed to welcome General Harbord into that

SOME OF THE MEMBERS AND GUESTS AT THE EIGHTEENTH ANNUAL MEETING, WASHINGTON, D. C., MAY 12, 1937

small but distinguished group of our fellow citizens who wear the Ordnance Medal of Merit.

"Gentlemen, we are now to hear an address by one of the greatest military historians of all time. From England the great Hilaire Belloc comes to us with a well-deserved reputation as analyst and commentator with few equals. Author of more than one hundred books, lecturer of note, military student of great attainments, I personally feel that there is no one anywhere whose viewpoint is more sound or whose knowledge more extensive.

"Our speaker has chosen what I believe to be the most important military subject of the times—'Yesterday's War is not Tomorrow's.' I present to you Mr. Hilaire Belloc." Mr. Belloc then addressed the meeting (page 13).

Following Mr. Belloc's address the presiding officer introduced Maj. Gen. William Crozier who spoke on "Force in the World of Today" (page 19). Himself an Army Ordnance Medalist, General Crozier was greeted with prolonged applause by many who had served under him in the Ordnance Department or in industry during his record service as Chief of Ordnance.

During the meeting music was played by an orchestra from the United States Army Band.

AT THE Aberdeen session the following afternoon, a new version of Ordnance Day was presented. It was strictly an engineering conference devoted to the observation and study of the engineering characteristics of the newer forms of field artillery and automotive matériel. Col. Charles M. Wesson, Commanding Officer of the Proving Ground, greeted the guests in an address of welcome at the Main Front. The program was under the direction of Col. R. W. Case, the demonstrations were conducted by Lieut. Col. K. F. Adamson, assisted by the commissioned and enlisted personnel of the Proving Ground. Maj. H. U. Wagner described the engineering characteristics of the matériel over the public address system of the U. S. Army Signal Corps.

This program of demonstrations began at 2 o'clock and concluded at 4. The following hour was devoted to examination and inspection of the matériel shown.

ARMY ORDNANCE, on behalf of the officers and members of the Association, extends to the Chief of Ordnance and the officers of his Department, especially the Commanding Officer and staff of the Aberdeen Proving Ground, grateful acknowledgment for an interesting program of demonstrations. The new approach to "Ordnance Day" was a striking improvement over the programs of former years.

PITTSBURGH

A JOINT dinner-meeting of the Pittsburgh Post of the Army Ordnance Association and the Pittsburgh Ordnance District was held in that city on April 24th with Mr. Frank B. Bell, District Chief, presiding as toastmaster.

The guests of honor were Maj. Gen. William H. Tschappat, Chief of Ordnance; Brig. Gen. H. W. Schull, Chief of Manufacturing Service and Assistant Chief of Ordnance; Brig. Gen. Benedict Crowell, president, Army Ordnance Association; Col. C. T. Harris, Jr., Director, Planning Branch, Office of the Assistant Secretary of War; Capt. D. N. Hauseman, Office of the Chief of Ordnance; and Maj. L. A. Codd, executive secretary of the Army Ordnance Association.

Following the dinner, Mr. Bell introduced General Tschappat who spoke on "Ordnance Preparedness" and General Schull who discussed some of the phases of the procurement-planning work in the Pittsburgh District.

At this point, Mr. Bell turned the meeting over to Col. H. A. Gidney, president of the Pittsburgh Post, who, after a brief greeting to those present, introduced General Crowell.

Referring to the two previous speakers—Generals Tschappat and Schull—General Crowell said: "They have discussed for us the *principles* of ordnance preparedness; I would like to say just a few words about the *people* of ordnance preparedness. I make the distinction because principles are created by and for people—either without the other is a futile state of affairs. As in all other cases, so with ordnance principles—they depend upon ordnance people. The responsibilities, the rights and duties, and the privileges are great. And these very things are no better or no worse than the high purpose of all of us who hold allegiance to the ordnance cause. . . . You and I as members of that (the Ordnance) family are devoted to a very vital principle. Expressed briefly the principle is this: Despising war, we are not unmindful of the past. The national defense is still, and for a long time to come will be, a very real thing. This defense does not depend entirely upon man power; it depends equally upon munitions power. And upon the ability of the United States to translate its peace-time production to munitions power in time of emergency, rests its national security."

Colonel Harris and Major Codd also addressed the meeting.

Maj. H. C. Minton, executive officer of the Pittsburgh Ordnance District, was in charge of arrangements. His effective work for ordnance mobilization planning in the Pittsburgh area was praised by the District Chief and applauded by the several hundred members who were present.

Hartford Ordnance District

LIEUT. Col. Francis H. Miles, formerly executive officer to the Chief of the Hartford Ordnance District, was honored at the Twelfth Annual Meeting of the district when he was awarded the Franklin Medal for Ordnance Service. The medal bears the name of Col. B. A. Franklin, District Chief. Colonel Miles has been assigned to the district for the past four years and has been transferred to the Army Industrial College where he will serve as a member of the faculty. He also was presented with an embossed testimonial of the high regard in which he and his work are held by the military and civilian members of the organization.

The meeting, at which nearly three hundred manufacturers and Reserve officers were present, was held at the Hotel Bond in Hartford on May 20th. Colonel Franklin presided at dinner and at the meeting which followed. The principal speaker was Maj. Gen. William H. Tschappat, Chief of Ordnance, who congratulated the District Chief and his associates on the record of ordnance progress in the Hartford area. Reports on procurement planning in their respective organizations were submitted by the following chiefs of divisions of the district: Lieut. Col. P. W. Bidwell, Chief of the Manufacturing Service; Lieut. Col. D. B. Wesson, Chief of General Service; and Lieut. Col. A. L. Bausman, Chief of Procurement Service. Col. Frederick H. Payne, Assistant District Chief, announced the award of the Franklin Medal to Colonel Miles. Other speakers at the meeting were Colonel Miles; Lieut. Col. Robert Sears, recently appointed executive officer of the district; and Maj. L. A. Codd, executive secretary of the Army Ordnance Association.

Preceding the dinner the members of the District Advisory Board held their annual meeting at which Colonel Franklin presided. Participating in the discussions of the board were General Tschappat, Col. T. J. Smith, Commanding Officer of the Springfield Armory and Capt. David N. Hauseman, Chief of the War Plans Section, Manufacturing Service, Office of the Chief of Ordnance.

Los Angeles

SINCE the brief account of the first annual meeting of the Los Angeles Post of the Association in the May-June issue of Army Ordnance, further information about this notable gathering has been received which seems to confirm the opinion that this is destined to become the most active and fastest growing Post in the country.

Approximately 200 members, guests, and visitors were present to witness the display and demonstration of ordnance equipment at March Field, Calif. They were welcomed by Brig. Gen. D. C. Emmons, commander of the First Wing, GHQ Air Force, and by Col. J. H. Pirie, commanding officer of March Field. Mr. Earl B. Gilmore, president of the Los Angeles Post gave the principal address.

However the meeting was a "see" meeting rather than a "talk" meeting. Under the able direction of Capt. Philip Schwartz, Ord. Dept., who planned the details, the visitors were kept busy during the entire day acquiring a first-hand knowledge of ordnance and the ordnance problem.

The program opened with the inspection of a group of airplanes including a Northrup attack ship and a Douglas B-18 bomber of the latest type. Under the command of Lieut. N. F. Forrest twenty-four bombs were dropped from three attack ships from a height of fifty feet. This was followed by examination of a fully armed attack airplane with bombs loaded on both the internal and external racks and with machine guns and ammunition installed.

Interest and excitement went up a notch at the next demonstration in which the four forward guns and the rear guns of an attack ship were fired from a ground position, followed by the firing of another machine gun from a ground mount.

The next event—lunch at the Officers' Club—also met with favorable response. So favorable, in fact, that part of the crowd had to be accommodated at the Post Exchange!

After lunch the demonstrations were resumed. The group witnessed the burning of smoke candles and the firing of aircraft signals, followed by the inspection of a bombardment hangar. Here the visitors saw nine 100-pound bombs loaded on a bomber which took off and dropped them from an altitude of 4000 feet.

Honor Guests at the Los Angeles Meeting

Left to right: Mr. Earl B. Gilmore, Brig. Gen. D. C. Emmons, Maj. Gen. E. B. Babbitt, Col. H. E. Yates, Capt. Ralph C. Scott, and Col. J. H. Pirie.

This bombing, incidentally, was done by Lieut. A. Luehman, Air Corps, a member of the Los Angeles Post of the Association. The ammunition magazine and bomb dump were then inspected. Here bombs and components for bombs weighing up to 2000 pounds were exhibited. The last event of the day was shooting on the pistol range where all who wished to do so were given an opportunity to test their skill.

And just to make it a perfect day, there was a surprise feature not included on the official program. This was the arrival of seven A-17 Northrup attack ships of the 17th Attack Group of March Field upon completion of their cross-country formation flight to Miami, Fla. and return, led by Maj. A. C. Foulk.

Among those present were Maj. Gen. E. B. Babbitt, former commanding general of the Ninth Corps Area and assistant to the Chief of Ordnance during the World War; Col. Wm. H. Neblett; Col. F. L. M. Masury; Col. H. E. Yates, in charge of Reserve activities of Southern California; Col. H. E. Wilcox; Lieut. Col. Carl F. White; Mr. Morton Anderson, who was closely connected with ordnance industries during the World War; and Mr. E. P. Querl, industrial commissioner of the Los Angeles Chamber of Commerce.

A particular vote of thanks is due to the men of the 4th platoon, 10th Ordnance Service Company, who explained the uses and functions of the equipment to the visitors, and to the 17th and 19th Groups who contributed their share by flying on their day off duty.

The activity of this Post is especially welcome in California where there are few heavy industries to which the ordnance problem particularly applies. Nevertheless, the Association is gradually making an impression there as the enthusiasm of those

attending this meeting shows. With the full coöperation of Colonel Pirie and Captain Schwartz, plans are afoot to make the meeting an annual affair and, in time, to develop it into a West Coast Army Ordnance Day.

ARMY ORDNANCE ASSOCIATION SCHOLARSHIP KEYS

WITH the cadet corps drawn up in parade formation in his honor, President Robert G. Sproul of University of California presented the Association's keys for ordnance scholarship to the senior and junior cadets who attained the highest scholastic standing in the Ordnance Unit of the R. O. T. C.

Those receiving the awards were Mr. Heinz P. Weber of Berkeley, Calif., senior student, whose 2-year average in the Ordnance Unit was 92.3; and Mr. Charles D. Y. Ostrom, Jr., San Francisco, junior student, whose 3-year average was 92.

The presentation, which took place on April 20th, was witnessed by Maj. Gen. George S. Simonds, Commanding General, Ninth Corps Area, by other distinguished officials and by several hundred civilian visitors. Maj. S. R. Stribling is in command of the Ordnance Unit, R. O. T. C. at the University.

At University of Oklahoma, the Association's keys were presented at the Military Convocation on May 4th at which President William B. Bizzell conferred the awards upon Mr. Nathan B. Chenault and Mr. Harry Clifford.

Mr. Chenault, of Witchita Falls, Tex., is a senior in the School of Petroleum Engineering. In addition to the scholarship key, he also received a saber as commanding officer, Honor Battalion, 1st semester, and a cup as the outstanding Ordnance senior. Mr. Clifford, of Chickasha, Okla., is a junior in the Military Department and in the School of Electrical Engineering.

The Ordnance Unit, organized at the University in the fall of 1934, graduated sixteen men this year. Capt. Jacob G. Sucher is in charge of the unit.

At Lehigh University, the scholarship keys were conferred during the annual Military Field Day exercises on May 10th. Dr. C. C. Williams, president of the University, presented the awards to Mr. W. H. Patterson, senior class, and to Mr. C. H. Hoffman, junior class.

Mr. Patterson, of Baltimore, Md., is in the mechanical engineering course at the University and Mr. Hoffman, of Allentown, Pa., is studying electrical engineering. Maj. Theodore C. Gerber is the Ordnance Unit instructor.

NEW MEMBERS

THE following have been admitted to membership in the Army Ordnance Association: F. G. Alexander, Chicago, Ill.; Capt. James F. Angier, Takoma Park, Md.; R. E. Anthony, Boston, Mass.; W. H. Austin, Hyde Park, Mass.

Robert A. Bagnell, City of La Due, Mo.; W. L. Barker, Fort Worden, Wash.; Justo P. Beauchamp, Post of San Juan, Porto Rico; C. H. Beech, Wilkinsburg, Pa.; R. E. Benson, Brooklyn, N. Y.; E. Payson Blanchard, Bridgeport, Conn.; Henry W. Blindow, Metuchen, N. J.; Roy H. Bower, Fort Screven, Ga.; James J. Brady, Newark, N. J.; W. S. Brewster, Cambridge, Mass.; E. C. Bullard, Bridgeport, Conn.; C. R. Burlingame, Pittsburgh, Pa.

Peter S. Carlson, Fort Devens, Mass.; L. S. Castleman, Everett, Mass.; Hanford Chambers, Camp Dix, N. J.; W. Palmer Clarkson, St. Louis, Mo.; Franklyn B. Cole, Jr., West Los Angeles, Calif.; Ben C. Comfort, St. Louis, Mo.; Peter Vail Converse, New Brunswick, N. J.; C. E. Costain, Detroit, Mich.; M. M. Craft, Fort Randolph, C. Z.

Steve Dalke, Toledo, Ohio; Hugh A. D'Arcy, Detroit, Mich.; B. J. DeSimone, Belmont, Mass.

George G. Eddy, Aberdeen Proving Ground, Md.; Alden Q. Ellis, Caldwell, Idaho.

A. L. Fabens, Jr., Boston, Mass.; R. A. Fischer, Chicago, Ill.; J. M. Freiberg, Cambridge, Mass.; G. Decker French, Davenport, Iowa.

Thomas L. Gaines, Langley Field, Va.; Al Goldsmith, Detroit, Mich.; A. F. Gould, East Lynn, Mass.; A. J. Graffeo, Medford, Mass.; H. P. Green, St. Louis, Mo.; K. M. Gunkel, Boston, Mass.

John W. Harrington, Worcester, Mass.; A. P. Heintz, Newton, Mass.; Wm. Hetherington, Jr., New York, N. Y.; W. W. Higham, Detroit, Mich.; B. T. Howes, Boston, Mass.; J. K. Y. Hum, Cambridge, Mass.

Thos. J. Israel, Plattsburg Barracks, N. Y.

Marvin L. Kaifer, Metuchen, N. J.; W. F. Kaufman, Boston, Mass.; Fred Key, East St. Louis, Ill.; C. C. King, Norfold Downs, Mass.; R. H. Koehrmann, Jr., Roslindale, Mass.

E. A. Langwish, Detroit, Mich.; Floyd P. Latham, Fort George G. Meade, Md.; N. F. Losco, Revere, Mass.; Wendell S. Lucas, Fort Devens, Mass.

John B. Maloney, Metuchen, N. J.; Newman M. Marsilius, Bridgeport, Conn.; John F. McCarthy, Cavalier, N. Dak.; C. R. McDonald, Chicago, Ill.; D. H. McIver, Detroit, Mich.; Frank W. McMillan, Metuchen, N. J.; Frank S. McNeal, Detroit, Mich.; Edw. J. Medart, St. Louis, Mo.; Louis Henry Mesker, Cleveland, Ohio; David Miller, Fort Worden, Wash.; Geo. Moister, Detroit, Mich.; Frank Elbert Morhart, Burns, Oregon; H. L. Morrison, Detroit, Mich. Frederick A. Niethamer, Washington, D. C.

E. J. O'Brien, Watertown, Mass.

T. S. Pendergast, Detroit, Mich.; J. J. Phillips, Cambridge, Mass.; H. S. Pope, Waltham, Mass.; H. T. Pott, St. Louis, Mo.

C. Wingate Reed, Washington, D. C.; W. B. Reed, Auburndale, Mass.; Ward M. Robinson, Cleveland, Ohio; John E. Russell, St. Louis, Mo.

H. I. Schlansker, Cambridge, Mass.; Rudolph I. Schonitzer, Cleveland, Ohio; J. H. Schroeder, Cleveland, Ohio; P. E. Sellers, Cambridge, Mass.; R. E. Sessler, Arlington, Mass.; Francis F. Shipton, Fort Meade, S. Dak.; Edward W. Smith, Washington, D. C.; S. Harold Smith, Cleveland, Ohio; P. N. Stamatos, Boston, Mass.; Rufus A. Stanfield, Fort Meade, S. Dak.; D. P. Surber, San Francisco, Calif.; F. S. Sutherland, East Chicago, Ind.

D. J. Taylor, Cambridge, Mass.; D. M. Thompson, Cambridge, Mass.; D. J. Torrans, Boston, Mass.

Walter Van Pattensteiger, Auburndale, Mass.

Walter H. Wendell, Detroit, Mich.; Andrew J. White, Boston, Mass.; A. M. White, Dorchester, Mass.; George E. Williams, Philadelphia, Pa.; B. H. Witherspoon, Buffalo, N. Y.

W. S. BRIMIJOIN

MR. W. S. Brimijoin, safety engineer for Hercules Powder Company, and a charter member of the Army Ordnance Association died on March 23rd at his home in Middletown, Del., following an illness of several weeks. Mr. Brimijoin would have completed thirty-one years of service with the company in July. He was well known and exceedingly popular among explosives engineers all over the country and among his office associates.

Mr. Brimijoin was born in Lisbon Falls, Maine, on January 12, 1884. He entered the employ of the duPont Company as acid supervisor at the Repauno plant in July 1906 and he became a member of Hercules Powder Company in April 1914.

NECROLOGY

NOTICE has been received of the death of the following members of the Association: John H. Barr, Ithaca, N. Y.; Lester W. Blyth, Cleveland, Ohio; E. P. Burrell, Cleveland, Ohio; Leo Finegan, Pittsburgh, Pa.; R. T. Hazelton, Cincinnati, Ohio; F. C. Langenberg, Burlington, N. J.; H. S. Wilkinson, New York, N. Y.; and Edward L. Voy, San Franicsco, Calif. To their relatives and friends ARMY ORDNANCE extends condolences.

Ordnance In Review

The Colt Centennial

By Lieut. Col. Calvin Goddard, *Ord. Res.*

THE ordnance enthusiast who enjoyed "Yankee Arms Maker—The Incredible Career of Samuel Colt," by Jack Rohan, that fascinating biography of the man who made "revolver" a household term, would do well to secure a copy of "A Century of Achievement," by Arthur L. Ulrich, secretary of the Colt Company and dean of its official staff (published by Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., 1937). This little volume (too many of the pages of which are devoted to current products, and too few to historical review) recounts briefly, but with a fair degree of completeness, the history of Colt arms from the turning out of the first commercial model in the Paterson, N. J., factory in 1836 to the development of its lineal descendants a

Fig. 1. Flat-top-target Variety of the Single-action Army Revolver

century later. Better still, it illustrates the majority of all types produced, early and late, so that he who would inform himself about the manifold varieties in which Colt offerings have been made and marketed, will find Mr. Ulrich's work an excellent reference source both for photographic and written records of the specimens it describes.

Most owners of present-day Colts are unacquainted with the fact that this firm once made single-shot muzzle-loading rifles, percussion revolving-cylinder rifles (first at Paterson, subsequently at Hartford), and revolving percussion shotguns as well. Many also do not know that it later produced double-barreled breechloading shotguns, in both hammer and hammerless types and single-shot metallic-cartridge rifles and carbines (Berdan's patent)—not to speak of lever-action repeating rifles (Burgess patent) similar in a measure to the early Winchesters, to be followed by "pump" or trombone-action types which were made until well past 1900. These latter were extremely handy weapons, and I have several of them in my collection, not for display alone, but for more practical purposes as well.

The Gatling gun, first rapid-fire piece to attain a place in the sun, was also a Colt product, to be succeeded by the Colt machine gun (Browning patent), of Philippine War service, and the later Brownings which we know today. Other machine weapons formerly made by the Colt Company include the Maxim, Benet-Mercié, and Vickers.

It is perhaps unfortunate that Mr. Ulrich has failed to supply photographs to accompany the descriptions of certain types of small arms which his company has produced, and that in some instances even the descriptions are lacking. Thus he fails to show cuts of specimens of the .45-70 double-barreled hammer rifle, made on the order of the double sporting rifles so popular with the British; the *heavy*-type double-action revolver as produced with short barrel and *without* rod ejector (although the ejector model is depicted); and the single-action army model of similar construction (with short barrel and no ejector). And he passes entirely over the "flat-top-target" variety of the single action Army (Fig. 1)—the scant consideration accorded these being the more accentuated when we realize that they are among the most sought-after of Colt (cartridge) products.

The wicked little caliber .41 Deringer is described and illustrated in its various models, and its name properly spelled (with

Fig. 2. Converted Percussion Revolvers

Top to bottom: (1) Cal. .38 rim-fire conversion of cal. .36 Colt percussion revolver; equipped with ejector and loading gate. (2) Cal. .38 rim-fire conversion of cal. .36 Colt percussion revolver; without ejector or loading gate. (3) Cal. .38 center-fire conversion of cal. .36 Colt percussion revolver; no ejector or loading gate.

two r's and not three). Yet we find pictured but a single specimen of that numerous and varied group of *conversions* of percussion revolvers to metallic-cartridge form, which constitute one of the most interesting groups in the entire Colt line (Fig. 2). At least one of these, the "Theur" conversion, rivals in rarity many of the scarcest Colt products, and well deserves description in any volume dealing with the history of that organization.

Fig. 3. Cal. .44 Center-fire Galand Revolver

Mr. Ulrich may be excused for "pointing with pride" to the fact that the caliber .41 "Cloverleaf" 4-shot cylinder model of

1870 "was the first revolver with *recessed cylinder*" (italics his), whereas the French .44 Perrin of Civil War use was so recessed, as was the Galand (also French) of similar caliber (Fig. 3) which was at least contemporary with the Cloverleaf, if not actually antedating it. It might be more correct, however, were he to insert the word "American" just before the word, "revolver."

To round out the Colt saga, one should acquire a copy of "The Revolving-Cylinder Colt Pistol Story," by James H. Edgerly (F. T. Dexter, Topeka, Kans., publisher, 1937). Here we find revealed much heretofore unpublished history of the doughty Colonel's trials and successes, with full descriptions and numerous illustrations of four unique models of the "Walker" type Colt now in the possession of the author. The mere mention of a "Colt-Walker," sends thrills down the spine of the true arms lover, for this constitutes the *crème de la crème* of any collection of early American percussion handguns. And the knowledge, as revealed by Mr. Edgerly, that before the "Whitneyville" Walker (*i.e.*, a model made under contract at the Whitney arms works near New Haven, Conn.,) took shape, the semilegendary "Paterson" Walker actually existed, if only in model form, should set at rest many a long-waged polemic on the subject. The fraternity of American arms collectors, and ordnance historians as well, are deep in Mr. Edgerly's debt for having penetrated the cloud of obscurity which formerly hung over the Colt record from 1839 to 1847, and for having made available the excellent photographs of the four models which form the subject of his monograph. These are reproduced, by permission, in Fig. 4. (All other illustrations are from specimens in Colonel Goddard's personal collection. These were photographed by Lieut. John H. Fowler, arms expert, Metropolitan Police Department, Washington, D. C.—ED. NOTE.)

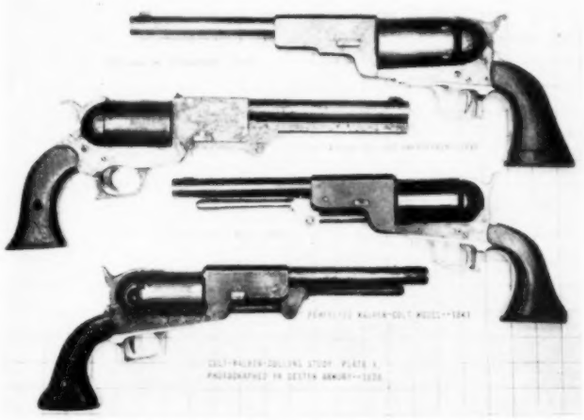

FIG. 4. THE COLT-WALKER-COLLINS REVOLVERS

Top to bottom: (1) Colt-Collins improvement, 1839. (2) Colt-Walker improvement, 1840. (3 and 4) Perfected Walker-Colt models, 1841.

INDEX TO VOLUME XVII

The Index to ARMY ORDNANCE, *Volume XVII, is now in preparation. The volume begins with the issue of July-August, 1936, and concludes with the issue of May-June, 1937. The index, with title page for binding, is arranged alphabetically by subject and author. Copies will be available shortly and will be sent to members and subscribers, without charge, upon application to: The Editorial Offices of* ARMY ORDNANCE, *806 Mills Building, Washington, D. C.*

Ordnance Field Service

FIELD SERVICE PROBLEMS, PART II

BY LIEUT. COL. RAYMOND MARSH, *Ord. Dept., U. S. Army**

This article was prepared prior to the recent issuance by the War Department of a tentative Infantry division organization, and was based on army organization as it then existed. The new organization, which is to be tested this summer, corrects many of the faults discussed in this article. After the results of the tests are made public, we hope to publish a series of articles covering Ordnance service in this new division. The 10th Ordnance Service Company has been organized, since this article was written, to provide Ordnance service for GHQ Air Force units. The organization of this company differs in many details from that herein proposed, but the general principles underlying its functions and operations remain unchanged.—EDITOR.

AMMUNITION supply is probably the biggest, the most difficult and the most vital of any problem which the Ordnance Department and mobile field troops must solve. It is the biggest because of its size and the tonnage involved. It is the most difficult because of the necessity for mobility and the difficulty of cross-country transport in war-torn areas. It is the most vital because without a reliable, adequate, and uninterrupted supply of ammunition, an army becomes merely a mass of men burdened with voluminous, heavy, and cumbersome impedimenta.

The only organizations provided exclusively for ammunition supply are the Ordnance ammunition companies and the ammunition trains of the Field Artillery brigade. At this writing an ammunition company consists of 6 officers and 164 enlisted men of all grades. This is not an ammunition transportation unit in any sense of the word. The transportation provided organically for this company consists merely of such transportation as may be required to move the company's baggage and other organizational equipment, and is limited to just a few trucks. This company is provided to supply the administrative and supervisory personnel required at ammunition establishments within the army area. The ammunition trains of the Field Artillery brigade consist of truck-drawn ammunition batteries and animal-drawn ammunition batteries, grouped into ammunition trains in varying combinations, together with the necessary train headquarters and headquarters battery. A truck-drawn ammunition battery has available for the transportation of ammunition, twenty-four 3-ton trucks with a capacity of seventy-two tons of ammunition. A horse-drawn ammunition battery has available for the transportation of ammunition, twenty-four escort wagons of 1½-ton capacity, giving a total ammunition-carrying capacity of the horse-drawn battery of thirty-six tons. Such additional services as may be required in the form of labor in the operation of ammunition establishments or in the preparation of ground for the establishment of an ammunition depot or distributing point, are furnished by labor elements of the Quartermaster Corps and by various units of the Engineer Corps, as may be required. Certain ammunition loads are prescribed for various transportation elements of Quartermaster Corps trains in the corps and division, as will be indicated later on.

We now may examine the distribution of these ammunition supply units. In the type field army organization, there is in the

*This discussion presents the personal views of the author and does not represent official policy on the subject.

army service group an Ordnance service group consisting of, among other things, three Ordnance ammunition companies. As I have indicated previously, it is the function of these ammunition companies to provide the administrative and supervisory personnel for the army ammunition depots and such other army ammunition installations as the army may find it necessary to set up. In the army artillery there is an ammunition train consisting of a train headquarters and a headquarters battery, and six truck-drawn ammunition batteries with a total capacity of 432 tons of ammunition. The army Quartermaster service includes a number of motor transport companies for which, at the present time, no prescribed loads are set up. The ammunition train and the motor transport companies of the army Quartermaster service constitute a pool of motor transport which may be used to such extent as the commanding general indicates in the transportation of ammunition.

In the corps, in the corps special troops organization, we find another Ordnance ammunition company. It is the function of this ammunition company to provide the administrative and supervisory personnel for such ammunition depots, dumps or other refilling points as may be established and operated by the corps. Should the corps be operating independently, it would undoubtedly be reënforced, as far as the ammunition supply service is concerned, by at least one of the three ammunition companies in the army. In the corps artillery brigade, there is an ammunition train consisting of five truck-drawn ammunition batteries and the necessary headquarters and headquarters battery. These five ammunition batteries have a capacity of 360 tons. In the corps Quartermaster service, in the corps Quartermaster trains, approximately 150 tons of small-arms ammunition and approximately 750 tons of artillery ammunition are carried. This amount of ammunition in the corps Quartermaster train is carried, not only for the corps troops themselves, but also for the divisions pertaining to the corps.

In the Infantry division there are no Ordnance ammunition units. In the artillery brigade of the Infantry division there is an ammunition train consisting of train headquarters and the headquarters battery, two truck-drawn ammunition batteries and, at this writing, one horse-drawn ammunition battery. This ammunition train has a capacity of 180 tons of ammunition. In the train of the Quartermaster regiment in the division, there are transported approximately 60 tons of small-arms ammunition.

It will be seen from the foregoing distribution of ammunition supply organizations and functions that there is a continuous intermingling of Ordnance, Quartermaster, and Field Artillery control and operation.

IF we continue our investigation of the present prescribed methods of operation of the ammunition supply service as set forth particularly in the Staff Officers' Field Manual and Field Artillery publications, certain salient characteristics stand out: 1. Ammunition supply is separated into the two categories of artillery and small-arms ammunition. 2. The Field Artillery, a combat element, an arm, is made responsible for the supply of its most essential item, namely, its ammunition. 3. In the division, the responsibility for an adequate ammunition supply is divided among the Field Artillery brigade commander, the division Quartermaster, and the division Ordnance officer. 4. The ammunition loads in the service trains are based on days of fire. 5. There are multiple channels of communication for the reports of expenditures, allocation of ammunition, and information related thereto. 6. Throughout the entire system there is a strange division of control and command and a most unmilitary and unsound separation of responsibility and authority. These characteristics can be considered only as criticisms and faults of the existing ammunition supply system. Their correction or the improved operation of an ammunition supply service under these criticisms and faults, constitutes the Field Service problem with respect to ammunition supply. They are deserving of detailed study and consideration.

Let us analyze these several salient features. It is becoming increasingly difficult to consider the supply of ammunition from the viewpoint of the two classifications of small-arms ammunition and artillery ammunition. At the present time, infantry fights quite as much by fire power as does artillery. While its fighting by movement still involves shock action, it now consists more or less of occupation of terrain, after the enemy has been driven from this terrain by superiority of fire. And this superiority of fire may consist quite as much of machine-gun and automatic small-caliber fire as of artillery fire. Consequently, the supply of ammunition is of as much importance to an infantry organization as to any other organization.

The practicability of dividing ammunition supply into these two categories is very materially complicated by the fact that all combat elements now have requirements for the same type of ammunition, notably, machine-gun ammunition of all calibers. The tanks use cannon ammunition. The antiaircraft artillery use caliber .30 and caliber .50 ammunition and also cannon ammunition. The Infantry use trench-mortar ammunition, and there is at the present time a movement on foot to organize, in the Field Artillery, mortar platoons which will use this same kind of ammunition.

As the supply of ammunition for all types and calibers of weapons becomes more and more complicated, and the requirements become more uniformly distributed throughout all combat elements, it is apparent that sometime, and perhaps in the very near future, the time-honored division of ammunition into the two classes of small-arms ammunition and artillery ammunition must inevitably break down. The indicated solution of this problem is to consider ammunition supply as a single supply problem, including the supply of all types, calibers, and combinations of ammunition.

THE question of ammunition supply in the division must, it is felt, be examined from the viewpoint of the division commander. He is the one who is responsible for the operations of the division. He is the one who receives the glory if the operations are successful and he is the one who receives the blame if the operations are not successful. At the present time this division commander, with all his responsibilities and all his capabilities for medals or courts martial, must look to his artillery brigade commander, his Ordnance officer, and his Quartermaster for an adequate supply of that on which the success of his division depends, namely, ammunition. Certainly the responsibilities of a division commander are such that he should not be compelled to have to coördinate the activities of three staff officers for the accomplishment of one service, namely, an adequate ammunition supply service. The indicated solution of this problem is the creation of a unified ammunition supply service, in the division particularly, and throughout the army in general.

When we consider that one of the fundamentals of supply is that the impetus of supply shall be from rear to front, it is strange to see, in this ammunition supply service, the doctrine established that the Field Artillery, one of the arms of the Army, shall be responsible for its supply of ammunition. When we consider that, in the official concept of a corps, it has no supply and administrative functions except for its own troops, it is strange to see in this ammunition supply service, the vesting of important supply functions in the corps chief of artillery. However, the doctrine that the supply of ammunition is a function of command is a principle to which the Field Artillery has long given adherence and support. This doctrine is supported by the provision, contained for years past in our Field Service regulations, to the effect that the organization and operation of an ammunition supply service is a function of the Artillery. It is partially supported by the fact that the reserve of artillery ammunition is the real artillery reserve. These two contentions could be discussed and argued indefinitely. Suffice to say, however, that they have been maintained in theory and organization only, and not in practice.

It is a matter of record that in the A. E. F. the ammunition supply service never attained a uniform method, universally applied. In other words, the A. E. F. experience did not prove that the Field Artillery doctrine and Field Service regulation principle constitute the only basis on which an efficient and effective ammunition supply service can be founded. Further, it did not prove that an ammunition supply service founded on any other basis was inherently unsatisfactory.

The Field Artillery trains which are employed in the supply of field artillery ammunition, are not combat trains but are service trains, and are classed as such in the current edition of the Staff Officers' Field Manual. As service trains, their movements are controlled largely by the appropriate G-4. Consequently, the artillery commander's control over these trains is not absolute and complete, but more or less limited. There appears to be little difference, when one considers the operation of these trains, whether they are under the control of the Artillery or one of the supply services. It is considered to be altogether logical to divest the Field Artillery of this problem and turn it over to a service.

EXPRESSING the loads of service trains in terms of days of fire is open to criticism. This day of fire is not a fixed unit but is described by the War Department as being a unit which is announced by the War Department at the beginning of each war or major campaign thereof, and may be changed from time to time based upon a consideration of current or contemplated military operations. This means, then, that a fixed military unit may carry in its organic transportation varying numbers of days of fire of ammunition. It would be preferable, it is believed, to establish the loads of ammunition of the service trains upon some relation based upon the capacity of the combat units to carry or absorb ammunition, rather than upon an arbitrary estimated consumption of ammunition which was reached as a result of our experience in France, with all the special conditions and circumstances under which, in the last two years of the war, combat was carried on. The employment of the term "a day of fire" will undoubtedly continue in command channels because of the length of time and extent to which it has been employed in our Army. Its use in such channels is not objectionable, but its employment in supply channels should be resisted vigorously.

As far as supply is concerned, the abstract term "day of fire" means practically nothing. What is required is very definite and concise information with respect to items and quantities of such items. As a unit of loading, it is apparent that its use is unsatisfactory and that some more definite measures should be employed, and further, that the loads of the several echelons of supply should be related to each other on the basis of some reasonable and logical principle. To correct this fault, the Ordnance Department repeatedly has recommended within the last few years that the loads of ammunition in the several echelons of supply should be related to each other on the basis of what has come to be known as the refill principle. This refill principle is not a unit of measure. It is a principle only. This principle, if applied, would set up a proper relationship between the ammunition loads which can be carried in the combat trains and which should be carried in the trains of the higher echelon of supply.

Briefly stated, this principle is that the quantities of ammunition transported in the several supply echelons should be so regulated and so related to each other that each echelon may completely fill the appropriate vehicles of the echelon next below it and, in turn, be completely filled by the loads of the ammunition vehicles of the echelon next above it, due consideration being given in each case to the additional types and varieties of ammunition which must be transported in each higher echelon.

If you will examine the several charts set forth in the old Field Service regulations and the current Staff Officers' Field Manual, covering the channels for allocation of ammunition, information concerning such allocations, reports of expenditures, and information concerning such reports, and then attempt to consolidate these several charts into one, you will appreciate the truth of my statement that there are multiple channels of communication for the reports of expenditures, allocations of ammunition, and information relating thereto. These multiple channels of communication can be eliminated by the creation of a unified ammunition supply service, coördinated and controlled in the normal channels for Class IV supplies.

To correct all of these several faults, the Ordnance Department repeatedly has recommended, within the past few years, the complete reorganization of the ammunition supply service. It has recommended that there be created a single unified ammunition supply service organized, operated, manned, and controlled by Ordnance personnel, under the command of the commanding general of the organization to which it belongs, with this command exercised through a single staff officer, the Ordnance officer, and controlled through the normal channels for Class IV supplies.

I DO not propose at this time to discuss the details of the recommended organization for ammunition supply. It will suffice to touch upon the organization only in general. In the division, it is recommended that the ammunition supply service should consist of an ammunition train which would include not only sufficient transportation and operating personnel to carry the desired ammunition but also sufficient additional personnel to handle this ammunition in loading and unloading, and to provide the necessary operating personnel at distributing points.

Such an organization would replace the elements of the Quartermaster regiment of the Infantry division, now employed in hauling small-arms ammunition. It would replace the elements of the service company of the Quartermaster regiment of the Infantry division, now engaged in handling ammunition at distributing points, division dumps, etc. It would replace the ammunition train of the Field Artillery brigade of the Infantry division, and it would replace the elements of the corps Quartermaster train, now carrying ammunition for the several Infantry divisions of the corps. Similar appropriate ammunition trains for corps and armies have been included in these recommendations.

Studies prepared in the Office of the Chief of Ordnance indicate that such an organization will effect material savings in personnel, animals, and vehicles, provided that from existing service organizations there be eliminated those elements whose present functions would be performed by the newly created ammunition trains. Such an organization also would insure greater flexibility of ammunition supply, would provide a larger common pool of ammunition transportation, and would give the highly desired unity of control, undivided authority and responsibility, and centralized command. It will eliminate the present miscellaneous ammunition-carrying units by their consolidation into one organization. By providing a pool of ammunition-carrying transportation, it will make it unnecessary to attach, detach, or otherwise reorganize units in order to obtain the desired flexibility in the supply of the several types and varieties of ammunition. If the loads in this ammunition train are prescribed in accordance with the recommended refill principle, they will provide the division commander at all times and under his undivided control, with one complete reloading or refill for all combat trains in his division.

Summing it up, it consolidates all ammunition service elements for the division into a single unit within the division, organically a part of it and under the undivided command of the division commander, exercised through a single staff officer and controlled through the normal channels for Class IV supplies. These recommendations are receiving the serious consideration of the War Department and all arms and services concerned. It earnestly is to be hoped that they ultimately will be adopted. If these recommendations are approved and put into effect, the formation in a division of a type of battalion of Ordnance troops is indicated. This Ordnance battalion would include the necessary headquarters, a maintenance service, a general supply service, and an ammunition supply service. (*To be continued in the next issue.*)

Professional Notes

MEASURING FRICTION AT HIGH VELOCITIES

By W. K. WOODS, *Lieut., Ord. Res.* and C. S. ROBINSON, *Lieut. Col., Ord. Res.*

ORDNANCE design work involving the theory of interior ballistics is handicapped by the scarcity of data on the friction between the moving projectile and the walls of the gun tube. If a projectile is rammed through a gun by purely mechanical means, as was done in experiments conducted at Watertown Arsenal,[1] the force exerted against friction at a relatively low velocity can be determined. However, correlation of data of this type in the ballistic equations leads to the prediction of muzzle velocities far below those obtained in actual firing. Since this evidence indicates that work expended against friction decreases very materially at the velocities encountered in general firing (2000 to 3000 feet per second) there is definite need for determination of the coefficient of friction between metallic surfaces at high velocities.

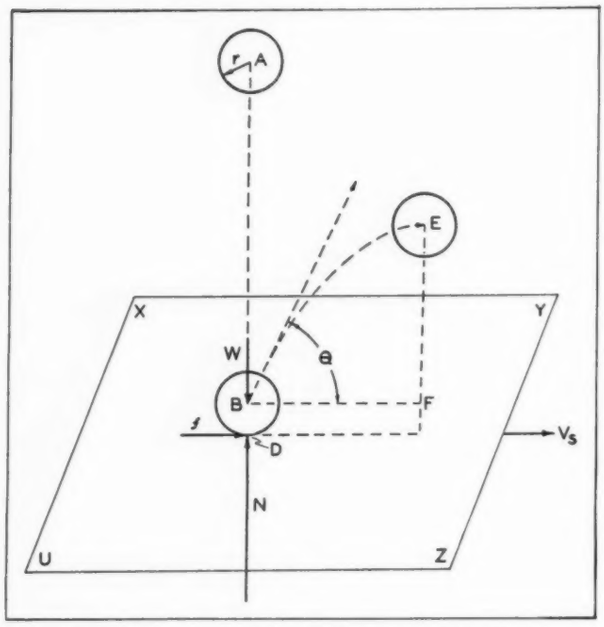

FIG. 1. DIAGRAM OF MOVING HORIZONTAL SURFACE

No intermetallic frictional measurements at velocities higher than one hundred feet per second have been recorded in the literature. Whether the apparent decrease in friction at higher velocities is the result of a decrease in the actual coefficient of kinetic friction between the two solid metals, the result of melting of the copper bands of the projectile, or a combination of the two effects is unknown. It is a recognized fact that coefficients of kinetic friction decrease with time,[2] due probably to the abrasive action on the surface, and, in this case, to the actual melting of the surfaces by the heat generated by the friction. Consequently, any method of measuring friction coefficients for studying the phenomenon of friction during firing must be made over a time interval of extremely short duration if the data is to be of value.

A thesis,[3] based on the above considerations, was conducted at the Massachusetts Institute of Technology to study the variation of friction with increasing velocity. It is the purpose of this article to describe the work done, with a view toward future refinement of the method and extension to a wider range of velocities and metals.

ANALYTICAL TREATMENT. If a steel ball is dropped on a level and stationary steel surface the time of contact between the ball and the surface is very brief. If the surface is stationary the ball will bounce back along the same path through which it fell; if, however, the surface is moving horizontally, frictional forces come into play which impart an horizontal velocity to the ball. Analytical mechanics makes possible the interpretation of this horizontal force in terms of coefficient of kinetic friction.

With reference to Fig. 1, surface $UXYZ$ represents an horizontal surface moving with a constant horizontal velocity (V's). A spherical ball of radius r is allowed to fall by gravity (without rotation) from position A, hitting the surface at point D while in position B, and bouncing to a maximum vertical height at position E. The coefficient of kinetic friction (μ) can be determined from Fig. 1 by the following formula:

$$\mu = (\sqrt{3.5}/2)\ (\overline{BF}/\overline{FE})\ (\sqrt{\overline{FE}/\overline{BA}})\ /\ [1 + \sqrt{\overline{FE}/\overline{BA}}]$$

EXPERIMENTAL PROCEDURE. The work was confined largely to steel bearings, one-half inch in diameter. The balls, in general, were released from an electromagnet activated with 60-cycle alternating current in order to minimize permanent magnetism on the ball. A thick piece of cardboard was taped onto the bottom end of the magnet. The cardboard was pierced with a hole of such size that a ball of a given diameter would fit into the hole far enough to be supported by the magnet and to be prevented by the sides of the hole from wobbling or from moving around the end of the magnet.

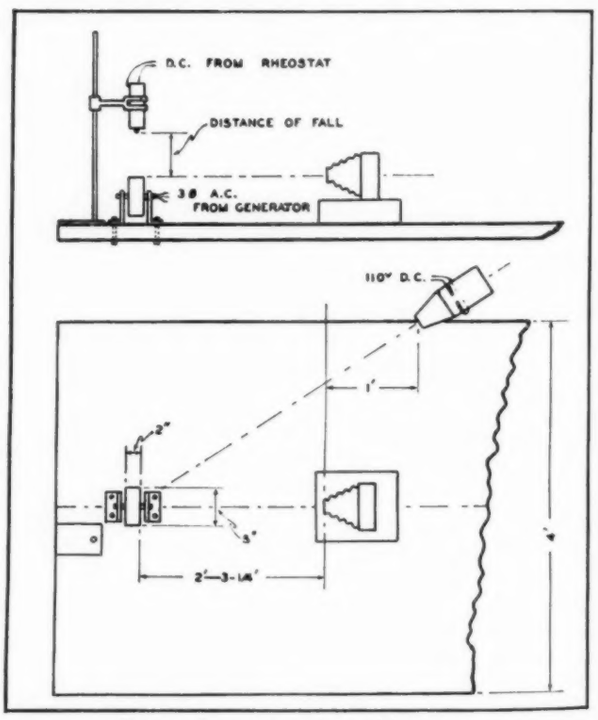

FIG. 2. ARRANGEMENT OF APPARATUS

1. Tschappat, W. H.: "Textbook of Ordnance and Gunnery"; pp. 138-141; John Wiley and Sons (1917).
2. Stanton, T. E.: "Friction"; chap. V, p. 150; Longman's Green and Co. (1923).
3. Woods, W. K.: "Coefficient of Friction between Metallic Surfaces at High Velocities"; S. M. Thesis, Chem. Eng., M. I. T. (1936).

The most serious experimental problem was obtaining a high velocity of the surface from which the ball bounced. The solution was found by using a gyroscope consisting of a small 3-phase induction motor installed in a forged steel drum 5 inches in diameter by 2 inches in thickness. Wires led to the stator of the motor through the axle of the drum. The stator was fastened to the stationary shaft and the rotor was built around the stator and confined in the drum. The gyroscope was mounted with the axis horizontal and driven by a U. S. Navy motor-generator set, Mark XXVI, Model 3, built by the Sperry Gyroscope Company. By allowing the gyroscope to come up to speed corresponding to an applied frequency, the slip became negligible and the angular velocity of the gyroscope was found to be five times the angular velocity of the motor-generator set. The angular velocity of the gyroscope was measured for purposes of calibration by means of a stroboscope; the angular velocity of the motor-generator set was measured with a tachometer.

By means of an arc light, sufficient illumination was obtained to allow a time exposure to be taken of the ball from the time it was released until it had passed the vertex of the arc after the first bounce. An Eastman No. 1 Autographic Junior camera was used with a U. S. 4 lens opening (equivalent to F/8) and Eastman verichrome film. The negatives were projected in an enlarging machine (enlarged three and a half times) and the projected image traced on a sheet of paper. The two ratios required for the above formula were determined from this tracing.

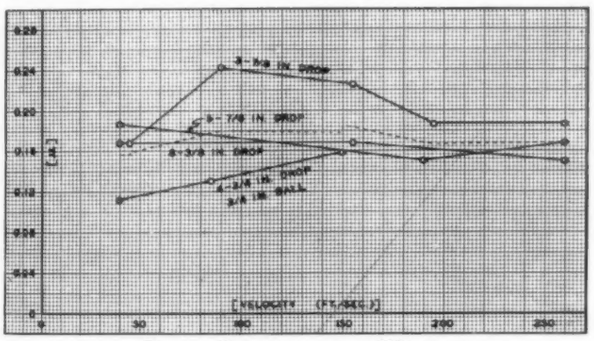

FIG. 3. RESULTS OF THE WORK

The apparatus was set up at one end of a long table as illustrated in Fig 2. Various distances of drop, various ball diameters, and various gyroscope speeds were the variables under consideration. A roll of eight pictures was used for a ball of a given diameter falling from a given height with a given peripheral velocity of the gyroscope drum. The results of the eight pictures were averaged for one reading. All tracings, of course, were made from the negatives of these pictures.

RESULTS. The results of the work are shown in Fig. 3. Photographic, tracing, and measurement inaccuracies are of minor importance. The unsatisfactory correlation of the data probably results solely from the fact that a curved surface was used. As long as the ball falls on a line with the axis of the gyroscope the above theoretical analysis is valid. However, if the ball should strike the gyroscope at a point on the periphery of the drum which is not vertically above the axis of the gyroscope the ball is no longer bouncing from an horizontal surface. It can be shown that

$$\mu' = \mu - \sqrt{3.5} \tan \theta \quad \text{(if } \theta \text{ is small)}$$

where μ' is the true coefficient of friction, μ is the coefficient of friction obtained by assuming the surface horizontal, and θ is the angle measured on the surface of the gyroscopic drum from the vertical to the point of contact, taken as positive when the point of contact is off the vertical in the direction of motion of the gyroscope. However, the coefficient is so sensitive to the value of θ that inaccuracies in determining the value of this angle defeat attempts to improve the correlation of the data by means of this correction. For example, the observed value of θ was occasionally so erroneous that a negative friction coefficient was obtained—an impossible result. Because of the larger dimensions, the value of μ can be determined quite accurately; under the optimum conditions the observed value of θ may be quite erroneous. The success of the method therefore depends upon keeping the angle θ as close to zero as possible.

Before the start of a roll of pictures, the magnet was centered above the gyroscope. Vibrations of the apparatus caused the ball to fall off center to one side or the other in a number of cases. Experimental evidence of this phenomenon was obtained when two exposures were taken on the same film without moving the camera. The slight deviation in the points where the two balls struck the drum resulted in quite different trajectories, despite the fact that the balls bounced to essentially the same maximum height. Yet it will be observed in Fig. 3 that the *average* friction coefficient (indicated by the dotted line) at any speed was quite close to 0.17. Recognized coefficients of friction[4] between dry metals are between 0.15 and 0.20. In other words, as the error due to neglect of the angle θ was averaged over a large number of pictures, positive and negative deviations tended to cancel and reasonable consistency of the data was obtained.

The data give no convincing evidence of a decrease in the coefficient of kinetic friction up to velocities as high as 260 feet per second. Though the work as described yielded results of limited accuracy, refinements in the apparatus and technique should provide satisfactory determinations of friction between metals at high velocities. The principal difficulty in applying the method to ordnance work consists of extending it to sufficiently high velocities that conclusions based on the method may be considered reasonably valid for the still higher velocities encountered in firing.

GERMAN ARTILLERY IN BELGIUM

By JAMES R. RANDOLPH, *Major, Ord. Res.*

WHEN the German Army invaded Belgium in 1914 it was accompanied by heavy artillery the effectiveness of which was conceded at the time to be one of the big surprises of the war; the forts at Liége, Namur, and Antwerp quickly succumbed to its bombardment.

These heavy siege guns, however, were not as powerful as guns then mounted on ships and in coast defenses. Germany's contribution to the art had been to make heavy guns road-mobile by dividing them into sections for transportation. And during the later stages of the war much heavier guns were used on railway mounts.

At the present time the heaviest field guns used by the American Army are the 155-mm. gun and the 240-mm. howitzer which can be transported in one piece. To guns of this size Germany added the Krupp 11-inch (280-mm.) howitzer, the Skoda 305-mm. howitzer, and a few 420-mm. howitzers, the latter being the largest guns ever designed to move with an army without dependence on railroads.

The Krupp 11-inch was neither new nor secret, having been described in the *Scientific American* for July 6, 1912. It had flat plates all around the rims of its wheels to keep it from sinking into soft ground, and when traveling, the barrel was removed and carried on a separate vehicle. This gun fired a projectile weighing 750 pounds, and had a range of 8092 yards. It had a maximum elevation of 65 degrees, a traverse of 10 degrees, and a length of 12 calibers.

The Austrian (Skoda) howtizer was really a stationary gun designed for rapid dismantling and assembly. It could be brought into action in forty minutes, once the ground was prepared, and

4. Rankine: "Smithsonian Physical Tables"; 8th ed., p. 204; Smithsonian Institute (1933).

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has been brought into action in as little as twenty-four minutes. This gun was slightly larger than the Krupp, having a bore of 12 inches, or 305-mm. Its proportions were about the same. It was fired preferably from a previously prepared concrete slab, such as could be obtained by making a garage floor thicker than usual, but it also carried a folding base which could be set in a shallow excavation and the gun assembled on it. Like the Krupp gun, the barrel traveled on a separate vehicle.

The 420-mm. gun (16.5-inch) was the largest used in the early stages of the war, but much more powerful weapons were used later, as the following comparison will show:

	German	*American*	
Diameter	16.5 inches	16 inches	14 inches
Length	12 calibers	25 calibers	50 calibers
Weight (gun)	21.5 tons	87 tons	105 tons
Projectile	1,570 pounds	2,100 pounds	1,560 pounds
Range	10,300 yards	24,500 yards	42,000 yards

The American guns here listed are modern railway guns. It will be noted that the 16-inch howitzer has more than double the range of the German howitzer, while the projectile of the 14-inch gun is only ten pounds lighter that than of the German howitzer, although its bore is 2.5 inches less.

When taken apart for transportation, this howitzer made five loads, and required thirteen tractors to move it. The barrel on its special wagon weighed twenty-nine tons. The mount formed a separate load, the base two loads, and the assembling gear a fifth.

They seem to have been a compromise, too heavy for a war of movement and not powerful enough for one of position, but in their first attacks on the Belgian forts they amply justified themselves.

BEFORE the war began, some of these forts were considered among the best in the world; but they had not been designed for defense against such heavy artillery. One wonders why this is so, since the guns had long been known to be available—it was only a question of getting them into position. (A gun having a bore of 16½ inches and a length of 48 feet was exhibited by Krupp at the World's Fair in Chicago in 1893.) An inspection of the design of the forts shows the concrete and earth protection apparently had been made as light as was considered safe, although the cost of much better protection would not have been a large proportion of the total cost of the forts.

Fortifications built during and since the war have been of very different design. Armored positions are now used chiefly for machine guns and the light cannon intended for use against tanks. The heavier guns, the targets of which are necessarily slow moving, are placed in concealed positions and fired by indirect methods. Infantry quarters are dug much deeper into the earth in order to protect their occupants from the demoralizing effect of heavy bombardment.

During the war, machine guns and trench mortars were found very effective against infantry; 37-mm. guns are effective against tanks. All of these guns can be handled by infantry; they can be taken into dugouts during bombardment, and brought out when it is over and the hostile tanks and infantry are advancing. Thus an effective aid to defense would consist of very large and deep caves with many small entrances, well hidden. Small guns in armored positions should be counted on merely to delay the enemy and force him to bring up his heavy guns. That, it seems, is the lesson of the Belgian forts.

It is worth while, also, to compare the range of these German guns with those of guns having a much greater mobility. The range of the 420-mm. howitzer was 10,300 yards; that of a 75-mm. may extend from 12,780 yards at 19 degrees elevation to 14,880 yards at 45 degrees, while that of an 155-mm. gun may go as high as 26,000 yards. Even some of the smaller howitzers have a range of over 12,000 yards.

Chronicle

THE nomination of the Hon. Harry H. Woodring as Secretary of War was confirmed by the Senate on May 6th, the members voting to notify the President immediately instead of witholding notification for two executive sessions, as is customary.

In a letter submitted to Congress opposing the enactment of legislation prohibiting the use of the military and naval forces of the United States to protect any private interest in this country or abroad, Secretary Woodring said: "Aside from the legality of the proposed legislation, it is objectionable from considerations of expediency and policy. The existing laws governing the use of the Army in civil disturbances are of long standing and unquestionable merit. Incidents of history have repeatedly illustrated that such use is an effective and necessary safeguard against needless bloodshed and destruction of property and the occasions of abuse of such power, if at all, have been enviously rare."

Recommending against a bill providing for the Army to furnish aircraft, instructors, equipment, and fuel to colleges for flight training, Mr. Woodring said: "The Army Air Corps is now short more than 1000 airplanes of the total of 2320 recommended by both the Drum and Baker boards. It is believed that the public interest dictates that the national defense be placed on a sound and adequate footing before any heavy expenditures which the training proposed in this bill will entail."

THE tenth annual observance of Army Day was celebrated on Tuesday, April 6th, under the sponsorship of the Military Order of the World War. President Roosevelt and Secretary of War Woodring reviewed a parade in Washington, and governors, mayors and other officials throughout the United States issued proclamations for the observance of this, the twentieth anniversary of the country's entry into the World War. In New York City, the celebration was held on April 10th when Maj. Gen. Frank R. McCoy, Commanding General of the Second Corps Area, led a parade down Fifth Avenue. At the Army Day dinner in Washington, Secretary Woodring told those present that this nation was not participating in an armament race. "On the contrary," he said, "we are only taking tardy action toward remedying some of the more glaring weaknesses in our national defenses."

The Senate Military Affairs Committee, in approving a bill authorizing the Army to sell a tract of land to the General Motors Corporation declared that the establishment of a Chevrolet automobile plant adjacent to the Holabird Quartermaster Depot in Baltimore, Md., "constitutes a military asset."

Nonmilitary appropriations under the War Department, which have in the past been grouped together with military appropriations, will now be considered in a separate measure. The late Representative James P. Buchanan (*Dem., Tex.*) chairman of the Appropriations Committee, issued orders, just before his death early in the session, which brought about the new procedure. The budget estimates for next year provide about $416,000,000 for military expenditures and $195,000,000 for nonmilitary items.

SENATOR DAVID I. WALSH (*Dem., Mass.*) chairman of the Senate Naval Affairs Committee in a speech before the Senate urged retirement and pay only for those officers of the Army, Navy, or Coast Guard who have had from five to ten years service. He declared that the huge cost of the payment

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of retired officers would cause a serious problem in the near future. "It seems . . . . the difficulty is that we ought to retire, without retirement pay and early in their careers, a much larger number of naval and military officers, and possibly Coast Guard officers, who are found to be unsuited and unfit. . . . I wish to say that I have for a sufficiently long time been a member of the Committee on Naval Affairs to have reached the conclusion that we must do away with the assumption that four years of free education means, no matter what disease comes afterward, that we are to retire officers on pay for the rest of their lives at Government expense. Retirement pay ought not to be allowed before an officer is from five to ten years in the service."

Senator Walsh recently has prepared with the coöperation of the Navy Department, a 70-page booklet entitled "The United States Navy" which gives a concise picture of this branch of the national defense. It is divided into seven chapters under the following titles: "History," "The Navy Department," "Shore Establishments," "The Fleet," "Personnel," "Naval Reserve," and "Marine Corps." It has been printed as a Senate document.

SUBSEQUENT to the destruction of the German dirigible, HINDENBURG, Secretary of the Navy Swanson stated that "the Navy will continue to study the possible utility of lighter-than-air ships for naval purposes. It has heretofore appeared," he said, "that their possible use for naval purposes does not justify the expenditure of funds necessary for their construction and operation. However, under continued study it may develop otherwise. The HINDENBURG tragedy will not adversely affect the Navy's decision in this matter because it resulted from a hydrogen fire and American ships use instead of the highly inflammable hydrogen, an inert gas, helium, which, while it has less lifting power than hydrogen, does not either burn or explode."

What is reported to be one of the greatest weight-carrying airplanes in the world, a new bombardment airplane, is nearing completion at Seattle, Wash., the War Department has announced. The new ship is basically similar to the YB-17—"the flying fortress" but it is even larger. It is a 4-engined, all-metal, midwing-type monoplane and is equipped with sleeping quarters, kitchenette, heating and ventilating systems and sound proofing.

A new-type fuel-feed system, now undergoing tests by United Air Lines, practically eliminates the usual aircraft engine carburetor. It may also solve the problems of carburetor ice and excessive intake heat. Besides this safety factor, the device, developed by the Bendix Corporation, holds out hopes of greater dependability and lower fuel consumption.

IN anticipation of larger planes making longer flights in the near future, the Federal Communications Commission has authorized the use of 5000 watts at communication division terminals of airlines. This power may be used "on condition that the operating frequency is maintained within 0.02 per cent of the assigned frequency and that suitable filters are embodied in the equipment to limit the frequency band of emission to five kilocycles." This new power will double the signal strength of the ground stations, it is said.

An airplane engine covering which is reported to increase the speed and efficiency of airplanes from ten to fifteen per cent has been announced recently by the National Advisory Committee for Aëronautics. The device is a doughnut-shaped movable metal ring known as the "nose-slot cowling."

Under the terms of a bill introduced into the House by Representative Maas, the construction of other than experimental airplanes or engines in the Naval Aircraft Factory in Philadelphia, Pa., would be prohibited. Three years ago Congress passed legislation requiring the Navy to construct one-tenth of its aircraft at the Philadelphia factory so that the construction might serve as a yardstick for private building costs. This recalls the long-idle Navy armor-plate plant at Charlestown, W. Va. It was erected years ago on the "yardstick" basis but it was soon found that commercial companies could produce much more economically.

Book Reviews

THE LIVING JEFFERSON. By James Truslow Adams. New York: Charles Scribner's Sons. 1936.

THE general excellence of all the works of this author entitles any of his books to a careful consideration. "The Living Jefferson" is no exception.

On the title page appears the following quotation from Woodrow Wilson, "The immortality of Thomas Jefferson does not lie in any one of his achievements, but in his attitude toward mankind." Mr. Adams appears to have taken that quotation as his text in his treatment of the subject. Although the facts of Jefferson's life are set forth rather completely, the emphasis of this book is placed upon the discussion and interpretation of Jefferson's acts and doctrines.

But splendid and complete as is Mr. Adams' discussion of Jefferson's acts and principles, I think the most interesting, and perhaps the most timely part of the book is the author's application of these principles and their interpretations to the history of these United States. A question that was raised, almost coincident with the first settlement, was "Who should rule?" This question and the struggles to decide it have persisted ever since in various forms.

"An interesting point about this American struggle is that it has a rhythm, a pulsebeat. About once every generation, or on an average of every thirty years, what we may call Americanism in the sense of a desire to free one's self from the trammels of being governed or exploited . . . . by others, has risen like a tide to high-water mark, resulting in loud protests, political upheavals, and even war, depending on the severity of the crisis."

Mr. Adams concludes that "what we need is not a Hamilton but a Jefferson, to persuade the masses, as Hamilton could never do, that the 'more abundant life,' if thought of only in terms of economics and state planning, will be ashes in our mouths if we cannot at the same time retain those personal liberties of action, speech, press, thought, and religion which alone make life worthy."

R. M.

CONTACT. By Charles Codman. Boston, Mass.: Little, Brown & Co. 1937. $2.00.

AS a war story "Contact" is not a notable book. It indicates no research to connect the author's flying experiences with the general war program, and deals too much with petty happenings. But "Contact" will give the future World War historian the atmosphere of flying in 1918.

The book tells of phony leave passes, of care-free parties, of silly child's play while only a few miles away comrades rotted in blood, and then flights that ended in "engine trouble," "flabby controls," "gun jamming," and other shortcomings that were blamed on the mechanical construction of the planes. Every ordnance mechanic who served in France has painful recollections of these things. If it were not for the records of a few serious flyers, the story of American World War flying would be a sad one indeed.

No insinuations are meant against the author of "Contact": the system was at fault. Reckless dare-deviltry was at that time thought to be the proper qualification for an aviator. It took a Lindbergh and modern licensed flyers to destroy that theory. Three years of war had not taught the Allies the lesson either; the author tells of many disastrous incidents.

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"Contact" confirms for the historian what the Ordnance has always preached—that youthful giddiness and complicated machinery do not mix well. Today in the handling of airplanes, tanks, and other mechanisms of war, Army men know that the requisites for service are calm determination, never-ending alertness, and a knowledge of every sound and vibration of the machine like a cavalryman knows his horse. "Contact" is the record of a costly past that should never be revived. G. S. B.

THE GUN FOUNDERS OF ENGLAND. By Charles ffoulkes. New York: The Macmillian Company. $7.50.

MILITARY men appear to concern themselves primarily with the future, next with the present, and last, and decidedly least, with the past. Whatever is obsolete, be it matériel or correspondence, must be burned, buried, sunk, or otherwise destroyed and gotten out of the way as soon as possible to make way for what is to come. Witness a War Department sale of waste paper (old records) some years back: an officer poking through a bundle which the ragman had missed, found a book, entirely in the handwriting of George Washington, recounting in detail the experiences of his army during that frightful winter at Valley Forge, and containing the oaths of allegiance of every officer in the force—himself included!

And so it is with genuine pleasure that we record the contribution of Charles ffoulkes, Esq., C.B., O.B.E., Master of Armories, the Tower of London, upon the gun founders of England, whose "laborious researches," as Lord Cottesloe states in his introduction to the present work, "are very valuable both as giving us a collection of facts and as outlining a little-known branch of military history."

That these researches must have been laborious in the extreme is evident when we realize that most of the author's studies deal with events of some hundreds of years past, written largely in Latin, ancient French, and Old English.

ffoulkes, in discussing the history of projectile weapons, refuses to take sides in the controversy as to where and when gunpowder was first used as a propellant, stating briefly that "the important point for present consideration is that explosive powder was available for military operations by the middle of the fourteenth century. . . . So gradual was the evolution of the gun and its varieties that the old names have persisted up to the present day. The mortar is simply the chemist's utensil, the cannon is the tube (*canna*) from which Greek fire was poured, and the gun is merely a contraction of the mangonel or great stone-throwing engine."

The author's studies reveal the fact that the first guns used in England were plainly of foreign manufacture and that the British lagged considerably behind their Continental contemporaries in the fabrication of these instruments of war. The first reference to cannon in English military service he finds to be dated 1345 when "the Keeper of the Wardrobe in the Tower was charged with the repair of ships' guns and the provision of ammunition." It is 1353 before a definite record of British-made ordnance appears, between which year and 1360 "William the Founder, and William of Aldgate, the brazier, were producing certain types—probably of brass. . . ."

The earliest English guns were cast, it appears, in London and Sussex. These were not Government made, but produced under contract, the state however undertaking to prove them, first in the heart of London, and later at Woolwich. And while the fact that careful proof tests date from the very beginning of British gun construction may at first appear unusual, when we reflect upon the crude methods employed in fabrication and the indifferent quality of metal available, we realize the absolute necessity for some such attempt to safeguard the lives of the gunners subsequently detailed to handle them.

ffoulkes explains the apparently anomalous fact that the very earliest guns loaded at the breech, rather than the muzzle, by the

statement that "it was impossible for the smith to make the barrel proper without a mandrel and therefore it had to be open at either end." His descriptions of the methods successively employed in barrel construction, as gathered from the few contemporary works available, are indeed fascinating and fill us with admiration for the resourcefulness of the artisans of the period. These doughty gentlemen thought nothing of casting a mammoth gun on the very spot where it was later to be employed in military operations, and the description of such an undertaking, as set forth on pages 13 and 14 of ffoulkes's work, is of absorbing interest. But not always were these affairs attended with success, even when carried out in foundries of the first class.

The industry forged ahead, however, and despite difficulty and discouragement, produced the guns which placed the British flag upon the seven seas and upon every quarter of the globe as well.

It is impossible in such brief space to do justice to the quantities of valuable material which this book contains. Suffice it to say that no comprehensive ordnance library can afford to be without it. C. G.

THE UNITED STATES ARMY IN WAR AND PEACE. By Oliver L. Spaulding, Colonel, U. S. Field Artillery. With 35 maps. New York: G. P. Putnam's Sons. 1937. $6.00.

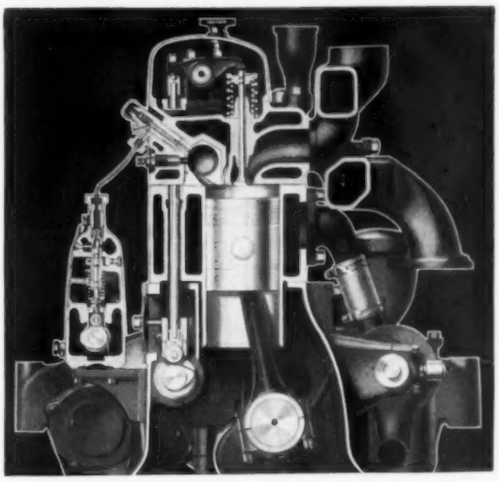
THIS is an extremely valuable contribution to an important field of American history that has been singularly uncrowded. Its only existing competitor is the excellent "History of the U. S. Army" published by Colonel Ganoe over a decade ago. These two works, however, have been written from decidedly different points of view and consequently they overlap in very few respects.

Colonel Spaulding is unusually well equipped for his task by reason of his long service in the Army, his scholarly attainments and because of his experience as Chief of the Historical Section of the Army War College. It is, therefore, not surprising that his work is characterized by scholarly organization and shows thorough familiarity with the rules of historical procedure.

There is much that is new in Colonel Spaulding's book. For example, the American Army did not spring from the soil like some new crop of dragon's teeth sown by an eighteenth century Cadmus in the thirteen Colonies. In the Colonial wars, many officers and organizations had obtained military experience that was of great importance to the American Army at the beginning of the Revolution. The genesis of our military establishment is accordingly sought not in the Army of the Revolution but in the armed forces of the Colonies with their intensive training in actual warfare prior to 1776.

On the assumption that a history of the Army is not merely a study of military operations, Colonel Spaulding holds that campaigns and battles are important events that influence the physical and spiritual development of the armed forces but "often we shall find some peaceful incident having greater influence upon the Army than some active campaign." The Army whose growth Colonel Spaulding describes with such care, accuracy, and deep understanding, is not alone a fighting machine but "an integral and essential part of the Government of the nation." It is not a "promoter of militarism or an instrument of oppression." In reality its contributions to the national peace-time development are manifold and a source of pride to its members who will discover in these pages the work of the Army as a pathfinder in the wilderness, a builder of vast public works, a help in all national emergencies, a promoter of public health, and finally the organizer of the Civilian Conservation Corps.

Since an Army is only as strong as its supply services, the omission of any reference to the Office of the Assistant Secretary of War and the Army Industrial College must be noted. It is to be hoped that future editions of Colonel Spaulding's work will include at least brief mention of the functions of the Office of the Assistant Secretary of War in coördinating the work of the supply branches and of the Army Industrial College in training



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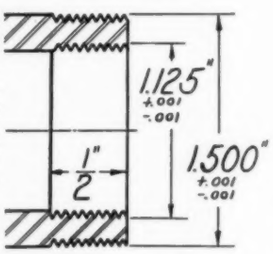

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Old Fuss and Feathers: The Life and Exploits of Lieut. Gen. Winfield Scott. By Arthur D. Howden Smith. New York: The Greystone Press. 1937. $4.00.

THE period from the American Revolution to the Civil War has been rather neglected in the field of popularly written history. In this life of General Scott, Mr. Smith has made a worth-while contribution toward filling the gap. Extremely well written in the modern style, with anecdotes well chosen to throw light on the times with which it deals, and with a refreshing and somewhat pungent humor in its comments, "Old Fuss and Feathers" carries the reader with thrilling tempo through the tremendous sweep of the sixty years of Scott's active life. Mr. Smith never hesitates to call a spade a spade. Without any attempt at muckraking, he debunks where debunking is needed. And popular concepts of our military history surely need it!

Though the book makes no attempt to rival biographies of the multivolume type, it is sufficiently thorough to give a reasonably satisfactory picture of the life and work of General Scott. Its attractive typography and moderate size make it a pleasure to read. A good index enhances its value as a reference.

General Scott seems but little appreciated by historians and critics of today. Perhaps this is because he is overshadowed by the "young gentlemen" whom he trained in the art of war. Their names form almost a roster of the commanders of both forces of the Civil War. Lee, Jackson, Grant, Sherman, Magruder, Huger, and many others of his young officers glistened in an immeasurably greater conflict than did their old commander. Perhaps his training of these future battle leaders was his greatest contribution to the military art. General Lee, especially, owed more to Scott in the way of military training, than to any other source. From Scott, Lee learned, and learned well, that the confidence and love of his men—the strength of all great leaders—must be purchased by kindliness, justice, and sincere devotion to their welfare. This, and much of Lee's strategy and military ability, surely came from his close service with Scott in the Mexican War.

General Scott's claim to fame does not, however, rest only upon this. In his own right he accomplished great things in the face of tremendous odds. Wellington, the victor of Waterloo, said of Scott's work in Mexico: "His campaign was unsurpassed in military annals. He is the greatest living soldier." As early as 1812, Scott began to forge ahead, though commissioned scarcely four years before. His vanity was so sincere and so boyishly frank, that it seemed an asset. Tactless by nature, his courage, creed of duty, and integrity, raised him so far above his contemporaries, that the close of the war found him the idol of the country. The first American officer since the Revolution to realize the necessity of grand tactics, he mastered them himself and taught them to the Army. Always a pioneer of progress in things military, he could well claim that the American Army of 1830 to 1860 was his creation more than of any man since Washington. His staff work, organization, and intelligence service, particularly in Mexico, place him well in the forefront of our military leaders. Scott's venture into the mess of politics was his greatest mistake and his most tragic misfortune. Though he was blameworthy for some of his political moves, he was far more sinned against than sinning. By proving his ineptness for a dirty game, he added to his stature as a man.

Besides recounting the life of General Scott, "Old Fuss and Feathers" presents a most interesting picture in outline form

of the social and economic life of this country a century ago. The author's drawing of President Jefferson as no realist, but as one with utter contempt for all soldiers, is worthy of note.

One fact stands out through all of General Scott's career to confound the pacifists of his day and of ours. Despite his overwhelming devotion to the Army and to all things military, he was consistently a peacemaker, and he always opposed the use of force save as a last resort. His long and active life spanned much of the making of America; it is difficult to overestimate his share in that achievement. F. W. F. G.

MARSHAL NEY—A DUAL LIFE. By LeGette Blythe. New York: Stackpole Sons. 1937. $3.50.

IF there have been doubts that Peter Stuart Ney, the schoolmaster of the Carolinas, was Marshal Ney of France, this work by its logical array of factual testimony has dispelled them.

The author spent years in historic research but was so meticulous in building his argument that he appears to have lost sight of some of the powerful drama. Unquestionably, the man who, in disgust over news from France, deliberately burned his memoirs, the work of fifteen years, was the same man who, in pique, tore up the orders of Napoleon on the retreat from Moscow. And could anyone doubt that the dying old man who cried in tears, "O God, I want to see my wife and boys," was not the same man who in France so many years before showed a passionate love for Aglae Ney and her sons?

One wonders why in twenty-nine years of exile, a character so strong as that of Marshal Ney could not have found some way of reuniting with his family. France had received back and honored the body of Napoleon. Why should it not have permitted the family of its great Marshal to depart in peace? Again, Ney might have invoked the intercession of the American Government. The only answer seems to be that a man can be on the one hand a physical hero and on the other a moral coward. The author has arrayed enough facts to show that this was characteristic of both Marshal Ney of France and Peter Ney of Carolina. There seems no doubt that the hero of a hundred battles of the Napoleonic wars now lies buried in the little churchyard near Salisbury, North Carolina.

The book also gives some new slants on the character of Bonaparte deduced from snatches of writings of Peter Ney, especially notations in books. Ney was not made by Napoleon, but certainly Napoleon could not have risen without the aid of Ney. If Bonaparte had accepted more of Ney's advice, perhaps the Emperor would not have made the many errors he did make. Behind the story in this book is a vision that Ney, not Napoleon, was the man intended by destiny for those troubled times, and that the selfsame characteristic of pettiness that caused him to lose the opportunity to guide the destinies of his country, also condemned him to years of exile from all he loved. G. S. B.

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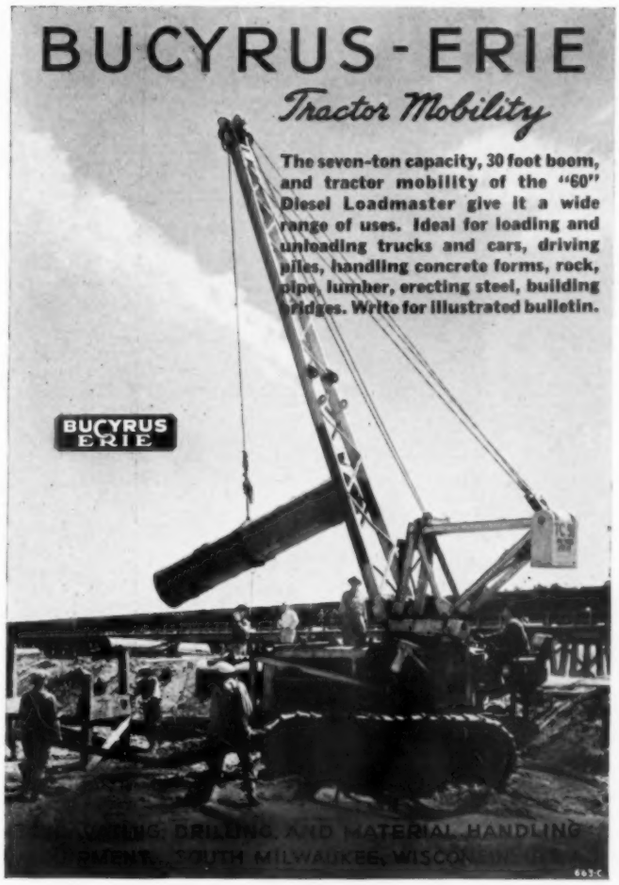

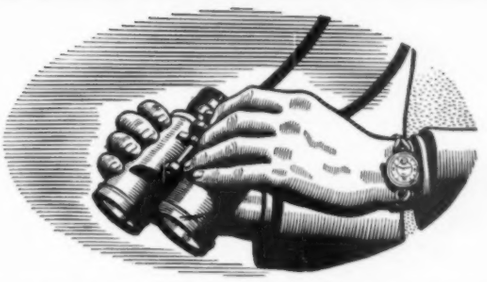

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